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LECTURES
ON THE
PRINCIPLES AND PRACTICE
OF
PHYSIC

DELIVERED AT KING'S COLLEGE, LONDON

BY

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THE FIFTH EDITION,

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TO

THE FIFTH EDITION.

FOR the little that needs to be said of the Fifth Edition of these Lectures, the Reader is referred to the brief EPILOGUE at the end of the Second Volume.

September, 1871.

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TO

THE FIRST EDITION.

The following Lectures were put together, with unavoidable haste, during the Medical Session of 1836–1837, in which they were first delivered. They were repeated, with slight variations, for four successive years; the Author always meditating, but never finding time to accomplish, their thorough reconstruction and revision. They were afterwards printed, to fulfil a rash promise, in the pages of the 'Medical Gazette:' and they are now published, in a collected form, at the request formally conveyed to him in writing, of many who had heard or read them, including several of his Colleagues at King's College.

Writing for mere beginners, and without any thought of future publication, the Author took no pains to note authorities as he went along. He may often therefore have used, without acknowledgment, not only the facts and reasonings, but sometimes, perhaps, the very words of others. This omission he regrets, but is now unable to supply. Neither has he leisure to correct, if that were desirable, the colloquial and familiar style in which the Lectures were originally composed.

Should they attract the notice of any who are no longer *in statu pupillari*, he would request such readers to bear in mind for whom these lessons were intended. They do not profess to present a formal and complete treatise on the Practice of Physic, much less to exhaust the various subjects upon which they touch. His chief hope is that they may prove useful as a text book for Students.

As they were passing through the press, such additions and alterations have been introduced as the Author would have made, had he continued to deliver the Lectures orally.

Henrietta Street, Cavendish Square:
September, 1843.

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INTRODUCTORY LECTURE.

The Course of Lectures which I am about to commence, and to which the present Lecture must be taken as introductory, has, as you know, for its scope and subject, *The Principles and Practice of Medicine.* As comprised within that title, various matters will come under our notice and consideration, and especially these things :—the phenomena that declare the presence of disease in the human body; explanations of those phenomena; the marks that distinguish one kind of disease from another; the causes of disease; and, finally, what is called its treatment.

This last is what is in our thoughts when we speak of the *Practice* of Medicine. All the rest are included among its *Principles.*

The Principles, then, of Medicine I shall lay before you, so far as I know them; and the Practice of Medicine I shall endeavour to teach you, so far as it can be taught in spoken discourse. But this practice, this art—which means skill in the detection, in the discrimination, and in the management of disease—can be taught but very imperfectly by mere description in a lecture-room. You can acquire it only at the bedside of the sick—clinically, as we say—each of you for himself, by his own direct observation, by the exercise and culture of his several senses. What I may hope to do is to show you how best and easiest to learn. It is this practical art of physic which is the one object of your pursuit in the Medical School of King's College, and towards your more ready and complete attainment of it your studies have proceeded by stages. Of one of these stages I hold the conduct. A further and a final stage, so far as the College is concerned, is to be passed in the wards of the Hospital; and it will be the most important stage of all. A very precious, but a very short and fleeting opportunity will your hospital attendance permit to most of you—an opportunity which, to those who engage themselves early in practice, and whose home will be in the country, can never come again. The loss or the neglect of it you will never cease bitterly to lament in after-life, yet its value is seldom fully estimated until too late. For turning to good account this golden period of your studentship it is my special business to try to prepare you. Very scanty, very needlessly scanty and worthless, will be the produce of your clinical study, however earnest, without some such preparation. You must first learn, as you may with ease, what others before you have learned slowly and with difficulty, and have garnered up for them who were to come after. Centuries of observation and research have accumulated a large and rich store of knowledge, essential to the profitable use of your short-lived hospital privileges. Without this previous information you would find yourselves in the disappointing and ridiculous position of one who should propose to visit some foreign land, while ignorant of its features and climate, of the manners and customs, the history, and even of the language of its inhabitants. How different must be the result, how much more lively the interest, how far larger the pleasure and the fruit of such a visit, after due preliminary enquiry into these and kindred topics—the more extensive and exact the better! It is to teach you what to look for, and how to see it intelligently—to enable you to read, to understand, to interpret the Book of Nature, when it is laid open before you—that these Lectures are mainly intended; to fit you, in one word, for clinical study, which again can alone fit you for the responsible duties, for the cares and anxieties, for the privileges and the comforts, of your future life in this world.

The Principles and the Practice of Medicine—in other words, the Science and the Art. An idle question is sometimes raised, whether Medicine can claim to be a science. Etymologically, Science means, simply, Knowledge. In its strictest modern sense it signifies demonstrable knowledge respecting the laws and the phenomena of the universe, and of this kind of knowledge there is much that lies within the province of Medicine. Much also there is which we are compelled to adopt and use, but which reaches to a higher or lower degree of probability only—knowledge incomplete, or as yet unproven. For myself, I am content with the definition of Science which has been given by Sir John Herschel:—'Science is the knowledge of many, orderly and methodically digested and arranged, so as to become attainable by one.'

In all cases, Art precedes and begets Science, lays its first foundations, and gives origin to its gradual construction. But soon, Science, so built up, begins to reflect new light upon its parent Art, helps it onwards, expands its range, corrects its errors, improves its methods, or suggests new ones. The stars were mapped and counted long before astronomy assumed any scientific form. From the earliest ages the pains and disorders of the human body must have arrested men's anxious attention, and claimed their succour. The facts observed, both as to hurts and diseases, and as to their attempted remedying, were handed down, by tradition or by record, from generation to generation, in continually increasing abundance; and out of the repeated survey and comparison of these has grown the recognition of certain laws of events and rules of action, which together constitute the Science of Medicine.

'Science,' says another great writer, 'ascertains principles —Art applies them.'

Now the principles or truths of a science may be imparted to a student; skill and facility in applying them to the useful purposes of life he must earn for himself. The art of healing, like every other practical art, is to be learned by its repeated exercise, by habit, by handling and examining the same objects, and doing the same things, over and over again; or, if they happen to demand no manual dexterity, by looking on, and seeing them done by others, again and again. The mind must serve an apprenticeship in this art, before it can presume to meddle practically with the great problems of human life and health. The unaided beginner is almost sure to blunder; and it is peculiar to our art that the blunders of first attempts may be both grievous and irremediable, may hurt or spoil the precious fabric they were intended to benefit. This Art of Physic needs, therefore, to be begun under the protecting eye, and to be led, in its earlier steps, by the practised hand of a master in the craft. Moreover, skill in observing is no less essential than skill in acting, and equally requires much use for its attainment. It may surprise you to be told, but it is strictly true, that our bodily senses—our eyes, our ears, our touch—however sharp and delicate they may have been made by nature, want a special course of training and education before their evidence can be trusted in the investigation of disease. You will find the same distinctions between the art and the science in all other departments of human inquiry. The principles of navigation may be thoroughly comprehended by a person who scarcely knows a rudder from a cable, and who would not be trusted—nay, who would not trust himself—with the conduct of the simplest boat. A man may master the noble science of astronomy, may be capable of working out on paper its sublimest and most abstruse problems, and yet be completely ignorant of the method of adjusting a telescope, and unable to ascertain for himself the position or the movements of a single star. But place such a person, night after night, in an observatory, let him watch and imitate the proceedings of some one already skilled in reading the appearances of the heavens, and listen to his practical instructions, and he will soon acquire the desired tact and facility for himself. Just so it is with that branch of knowledge with which we are concerned. It is in the wards of a hospital, or in the domestic chamber—it is among the sick and the dying, and there alone, that you can either thoroughly or safely learn to practise physic.

Your course of study here has, I say, been thrown, for your better help and convenience, into steps or stages, and several of these stages you have already gone through. The indispensable stage of Anatomy and Physiology I must take for granted that you have passed and conquered—indispensable for your immediate end, which is to acquire skill in the art of healing, your purposed life-work. But do not think that I am wandering from my proper subject when I bid you to remember how profoundly interesting, how almost awful, is this study in itself and for its own sake, revealing, as it surely does, the inimitable workmanship of a Hand that is Divine. Do not lose or disregard that grand and astonishing lesson. Do not listen to those who may tell you not to look for the evidence of purpose in this field of study; that the visible mechanism of that intricate but marvellously perfect and harmonious work, the animal body—the numberless examples it contains of means suited to ends, of fitness for a use, of even prospective arrangements to meet future needs, of direct provisions for happiness and enjoyment—that all these have no force at all, in true philosophy, as evidences of design. For my own part, I declare that I can no more avoid perceiving, with my mental vision, the evidential marks of purpose in the structure of the body, than I can help seeing with my open eyes, in broad daylight, the objects that stand before my face. There are, however, minds—very powerful and cultivated minds too—that cannot, or will not, or at least do not, recognise or acknowledge these teachings of Anatomy, but denounce as unscientific and unsound *all* reference to final causes in Nature. To me, believing in their honesty, this is intelligible only on the hypothesis, suggested by an eminent living philosopher and anatomist, that the minds in question labour under some defect analogous to that which renders certain eyes imperfect and untrustworthy, and which has received the name of *colour-blindness.* It is upon the facts of anatomy in its broadest sense that Paley 'takes his stand' in his unrivalled argument for Natural Theology—an argument in which I can trace no flaw; and sixteen centuries before him Galen had felt that, in writing his anatomical treatises, he was composing a hymn to the Deity—that a display so indicative of the being, the wisdom, the power, and the goodness of God, was a service of piety and praise. But beyond, though not above, these sublimer objects of a diligent investigation of man's bodily structure, we have another and still a noble end; and it is my business to take you one step nearer to that end.

Hitherto you have been told of structure and of function; henceforward our theme must be of health and of disease—of health, that we may understand disease; of disease, that we may, under Providence, promote the return of health. Our objects are to preserve the one—to prevent, remove, or mitigate the other.

What then do these contrasted terms denote?

Health is represented in the natural or standard condition of the living body. It is not easy to express that condition in a few words, nor is it necessary. My wish is to be intelligible rather than scholastic; and I should puzzle myself, as well as you, were I to attempt to lay down a strict and scientific definition of what is meant by the term health. It is sufficient for our purpose to say, that it implies freedom from pain and sickness; freedom also from all those changes in the natural fabric of the body that endanger life, or impede the easy, regular, and effectual exercise of the vital functions.

It is plain that health does not signify any fixed and immutable condition of the body. The standard of health varies, in different persons, according to age, sex, and original constitution; and in the same person even, from week to week, or from day to day, within certain limits it may shift and librate.

Neither does health necessarily imply the integrity of all the bodily organs: it is not incompatible with great and permanent alterations, nor even with the loss of parts that are not vital—as of an arm, a leg, or an eye.

If we can form and fix in our minds a clear conception of the state of health, we shall have little difficulty in comprehending what is meant by disease, which consists in some deviation from that state; some uneasy or unnatural sensation of which the patient is aware; some embarrassment of function, perceptible by himself, or by others; or some unsafe, though hidden, condition of which he may be quite unconscious: some mode, in short, of being, or of action, or of feeling, different from those which are proper to health.

I use the word *disease* generically; and I must here caution you against the strange mistake, too often made or imputed, of regarding disease as a thing, or (as the phrase goes) a 'separate entity,' by which the body is possessed and damaged—something which can be contemplated as apart from the body, which it may invade. Briefly, diseases are unnatural conditions of some part or parts of the living machine: not that every unnatural condition will bear to be spoken of as a disease, but every disease is an unnatural condition. There are many such unnatural conditions, which for our purpose require to be considered separately, and to receive distinctive names. For the most part disease consists in some derangement, suspension, or perversion of the continuous, normal, nutritive mutation and renewal of the bodily tissues. As synonyms of disease, taken in its general sense, I shall not scruple, for the sake of convenience, and in order to avoid the perpetual and tiresome recurrence of the same word, to use the terms disorder, complaint, distemper, malady, illness.

The number of these deviations from the standard of health, of these unnatural conditions—in one word, the whole number of *diseases*, if we include all their differences in kind and in degree—is scarcely calculable; and the first thing requisite towards investigating the laws that govern their phenomena, is, that we should break them into groups, and dispose them according to some principle of order.

Now, there are various methods in which this first broad classification of diseases might be framed.

The most cursory examination of the animal economy suffices to show that it is made up, not merely of separate and dissimilar parts, but of several distinct systems. There is one set of organs for the mechanical circulation of the blood; there is an apparatus expressly designed for repeatedly bringing the blood into contact with the air; a complex system of bones and muscles for the purposes of locomotion; a system for governing the movements, and evincing the feelings of the body; another system for receiving, preparing, and appropriating its nourishment; another for the production of matters that are useful, or essential to its functions; another for carrying off its impurities, and for removing its superfluous or effete materials; and another for the continuance of the species.

Now, each of these systems is liable to changes of structure, and disturbances of function, peculiar to itself; and these peculiarities must be taken into account, whatever may be the order adopted in treating of diseases in detail. But I shall not divide the subject, as some have done, into diseases of the circulating system—diseases of the respiratory system—diseases of the nervous system—and so on; for this, among other reasons, that there are many forms of disorder that affect all these systems in common, or simultaneously, and comparatively few that are strictly confined to any one of them.

Neither, in the Lectures which I am about to commence, shall I classify diseases according to the several *tissues* of which the animal frame is composed. In speaking of diseases in general, it will, indeed, be both proper and necessary to explain in what manner the same morbid process may be modified by the nature of the special tissue affected. But as the entire body is more or less penetrated and pervaded by the intermixture of several of these tissues, so no useful nor lucid arrangement of diseases could be founded on this basis.

Nor shall I attempt to construct a nosological system, by grouping together certain sets of symptoms, and calling each set, in its collective form, a disease.

To say the truth, I shall, in framing my plan, consider convenience and usefulness, rather than an appearance of scientific precision: and if I make one principle of arrangement more prominent than another, it will be that which relates to the anatomy of regions—the place and position of organs. At the same time, I shall not omit to borrow in part from some of those other methods to which I have just been referring.

Before, however, we enquire into the *nature* of particular diseases, it will be requisite to give some general account of the different ways in which the various parts of the body are liable to be altered in structure, or disordered in function; and before we speak of the *signs* of particular diseases, it will be proper to take a general view of symptoms, and of their ascertained relations with the several forms of altered structure: for doubtless you are aware that although diseases are not *constituted* by symptoms, they are, in the living body, *disclosed* by symptoms. Sometimes the symptoms are outward signals, which alone reach our senses, and through which internal changes declare themselves; and we then have to decipher and to interpret those signals. Sometimes we *see* the morbid conditions themselves on the surface of the body, or in other parts within our ken—such as the deep-seated textures of the organ of vision, through its transparent face; nay, what is truly surprising, we are able, by the aid of a simple instrument, to look into the organ of voice, and observe its structure, working, and exact state. Some internal disorders we can recognise as surely by the touch, or by the sense of hearing; and of some we infer the existence, or the non-existence, from the chemical or the sensible qualities of the natural excretions; or, again, from the proneness to, or the prevalent exemption from, morbid changes, by which our observation has taught us that certain hidden parts or organs are characterised. Lastly, there are some maladies the existence of which we learn solely through the fallible testimony of the sick man.

After death, diseases are often to be traced by visible changes of structure in the internal parts of the body. These changes are extremely interesting, as illustrative of morbid processes: they throw light upon what is past—they afford some guidance for the time to come. But, for obvious reasons, those signs which reveal diseases during life are, practically, of chief moment. In truth, the great object of our art is to prevent or postpone the disclosure of the others. The instruction afforded by the dead body comes too late to be of use in that particular case.

The morbid physical conditions from which the symptoms flow, are not always to be detected, either before or after dissolution. Neither, when they are detected, is their connexion with the symptoms always evident.

Besides enquiring into the modes in which the various organs and textures of the body may be spoiled, and into the signals or symptoms by which the presence of disease may be ascertained, it will be expedient to premise something, in a general manner, of the *causes* of disease, both with a view to its cure, and, what is much better, to its prevention. We shall also find it very useful to institute a short enquiry into the different ways in which death may take place—the different processes of dying.

There is one morbid condition, or process, to which all parts of the body are liable, and which contributes so largely and so frequently to alterations both of texture and function, that it claims our especial attention when discussing the more general facts and doctrines of pathology: I allude to that change, or series of changes, which we comprehend under the term *inflammation.*

It will be necessary, therefore, in the preliminary part of the course, to give a general account of inflammation; and this account must chiefly be drawn from those of its phenomena which are most familiar to us—which we can see and handle; those which we witness when the disorder is seated in or near the surface, in the skin, in certain of the mucous membranes, or in the subjacent areolar tissue. Then we shall pursue the examination of its peculiar phenomena, as they are presented and modified in the other tissues of the body—the mucous, serous, fibrous, parenchymatous, muscular, and nervous tissues; and here the *general* principles of treatment applicable to inflammation may be laid down, with the variations required according to the tissues interested.

In this part of the course may also be conveniently discussed the modifications of inflammation, and of morbid conditions generally, by the influence of certain *diatheses*, or peculiar dispositions of the body. Some constitutional morbific tendencies we shall find to be innate or hereditary—such are the scrofulous and the cancerous dispositions: others, again, are plainly acquired, as that in which the whole system may be tainted, for a longer or shorter period, by the venereal poison.

Hæmorrhages, also—and serous accumulations, or *dropsies*—as they are liable to occur in all parts of the body, require to be treated of generally, before they pass under our notice in the list of particular maladies. There are certain facts and reasonings common to all inflammations, to all hæmorrhages, to all dropsies. By combining these 'generalities' into one comprehensive statement, we help the memory, avoid needless repetitions, and find room for the exposition of principles.

Diseases themselves, in the mass, are sometimes distinguished, according as they are *general* or *local.* The distinction is convenient, though it may not be very exact or logical.

General diseases are those in which the whole body appears to partake in the morbid process going on. Strictly speaking, they are diseases in which some one system of the body, distributed through every part of it, is primarily or principally affected: for example, diseases in which the blood, which visits and circulates through every part and organ, is in an unnatural or unhealthy condition, or carries with it some noxious material; or, again, in which the nervous system, throughout the whole or the larger part of its extent, is deranged.

Local diseases, on the other hand, are those in which certain definite parts of the body are alone concerned, and which do not extend beyond, or much beyond, those parts, but leave the remaining parts, and the system at large, healthy both in texture and in function.

There are indeed diseases, which, occupying a definite portion only of the body, do nevertheless produce manifest and serious disturbance in the functions of various other parts, and (it may perhaps be said) of the whole system. Inflammation of a small portion of the frame may give rise to much secondary fever; yet here also we properly speak of the disease as being local, the secondary general disorder resulting from the local and primary, following it in point of time, and subsiding upon its cessation.

There are some unnatural conditions, or diseases, which we may rank as intermediate between these—as being general, in the sense of having more than one local seat at the same time, perhaps many. Thus *dropsy*, like hæmorrhage and inflammation, may appear in various parts of the body separately; it may even extend at once to all parts capable of receiving and retaining serous fluid—in other words, besides filling the larger serous cavities, the effused fluid may occupy the universal areolar tissue. But this apparently general dropsy will be found, upon careful examination, to resolve itself, in most cases at least, into local disease within the thorax, or within the abdomen.

Again, there are some diseases to which the epithet *constitutional* has been prefixed—diseases in which more than one part, often many parts, of the body are tenanted, simultaneously or in succession, by morbid conditions of the same kind and character; as when cancerous growths, or tubercular deposits, are found scattered here and there throughout the frame.

The first part, then, of the course will embrace an outline of General Pathology, with especial reference to those morbid conditions which fall to the care of the physician. In its relations to Surgery and to Midwifery, Pathology will be more particularly taught by the respective Professors of those distinct though kindred departments of Medicine. Do not, however, imagine that I take no interest in these, or that there can be anything different in the principles upon which are founded the several branches of pathological science. The truth is that you cannot, if you would, separate the one from the other. You can neither understand what may be called Medical Pathology without learning much which belongs as strictly to Surgical Pathology; nor can you be ignorant of either, without being in many important respects deficient in the other also. But the open field of pathology is of wide extent; and although we may, and must, survey the whole, yet its artificial divisions, its inclosures and allotments, will be cultivated best, and most improved, by a division of labour.

Afterwards, separate diseases are to be described and considered—all such, at least, as admit of being individualised, or presented under a definite shape. And here, I repeat, I shall chiefly pursue an anatomical order, as being comprehensive and inartificial, and as tending to facilitate diagnosis. The diseases of parts which lie near each other are the most liable to be confounded.

I shall begin, therefore, with the diseases of the parts that appertain to the head and spinal cord, and then proceed in succession to those of the parts belonging to the neck, the thorax, and the abdomen; to those of the joints, the muscles, and the skin. I shall not scruple, however, to deviate from this order, whenever, by doing so, I can promote your convenience or advantage.

With that portion of the course which relates to particular diseases, I shall also interweave certain pathological considerations, applicable not so much to the whole body, as to the several great systems of which it is made up. Thus, when I come to the brain, I shall speak of the functions peculiar to the *nervous system*, and of the obstructions and disturbances to which those functions are obnoxious, by way of preface to a detailed examination of the various affections of the several parts of that system. Before discussing the diseases of the chest, I shall bring before you, in a general view, the manner in which the great functions of *respiration* and of *circulation* are liable to be impeded, or otherwise disordered. As preparatory to the consideration of the diseases of the abdomen, I shall treat, in the same way, of the functions of *nutrition*; and of *waste*, which implies an interruption of those functions.

Still there would remain certain diseases, which would not necessarily find a place in this arrangement, inasmuch as their seat is uncertain, or only guessed at. Ague is one of these, Hysteria perhaps another. It is quite unimportant whereabouts in the Course such maladies are considered. I feel no concern about any imputations of imperfect or clumsy arrangement with which the plan that I propose to adopt may appear chargeable. The chief use of classification is to facilitate the recollection of particular facts. I had rather *not* be cramped and hampered by attempting what abler heads than mine have failed to achieve, and what in truth I believe, in the present state of our science, to be impossible—a complete methodical system of nosology. My object will be to furnish as much instruction and information as I can, in the way that seems most likely to be practically useful to you.

Ague I shall take leave to include among the disorders of the nervous system; and with it, the important subject of malaria will necessarily engage much of our attention.

The great question of contagion I shall consider in connection with continued fevers, which I rank among that remarkable class of diseases, the contagious exanthemata of Cullen.

Of sympathetic and of hectic fever, I must speak when upon the subject of inflammation.

This, then, is a sketch of the method I propose to follow. In the earlier Lectures, with the General Pathology, I shall endeavour to lay down principles. To these principles I shall continually refer, as occasions offer, both in those prefatory remarks with which I purpose to introduce the diseases belonging to the several great systems that contribute to form the body, and also in what I shall subsequently have to say concerning those diseases themselves in detail. In this way I hope to combine the advantage of repetition—which was the peculiar advantage of two short courses in a season—with that of greater completeness which forms the recommendation of a single extended course. The same great advantage of repetition—or, I should rather say, of recapitulation—will be further aimed at in the stated examinations of the class.

Having settled the framework and order of his discourses, the next aim of the lecturer must be to collect and arrange from the voluminous and bewildering records of Medicine, and from the necessarily more slender stores of his personal experience, whatever it may seem of consequence that his hearers should know concerning each distinct form of disease, as it comes before them for consideration: to state all the facts which are well ascertained, and which tend to explain its symptoms, to elucidate its origin, to identify its nature, to direct its treatment, to accomplish its prevention: to sift the true facts from the false, the important from the trivial, the essential from the accidental: to analyse the relations of these facts, and, ascending from particulars to generals, to point out those great principles and precepts which furnish the key to both the knowledge and the management of all diseases of the same kind. It may even sometimes be his duty to notice and discuss mere theoretical opinions; to express his own views upon disputed or undecided questions; and to admonish his audience against the danger of being led away by ingenious refinements, by the speciousness of novelty, or the boldness of speculation, from the more secure and settled results of careful observation improved by patient thought.

These duties of a lecturer on Medicine are metaphorically, but aptly, set forth in the following passage from Lord Bacon:—

'Formica colligit, et utitur, ut faciunt empirici; aranea ex se fila educit, neque a particularibus materiam petit, ita faciunt medici speculativi ac mere sophistici; apis denique cæteris se melius gerit. Hæc indigesta e floribus mella colligit, deinde in viscerum cellulis concocta maturat, iisdem tamdiu insudat, donec ad integram perfectionem perduxerit.'

I may venture to paraphrase the lesson thus:—

Be not like the empiric ant, who collects from every side indiscriminately for present wants; nor speculative, like the spider, who, seeking no materials abroad, spins his web of sophistry from the recesses of his inner being; but imitate rather the praiseworthy bee, who, gathering crude honey from various flowers, stores it up within, and, by his own operation, matures and perfects it for future use.

I have laid before you, Gentlemen, the main objects which I shall endeavour to keep steadily in view during the series of lectures I am about to commence; and I should discredit the chair I have the honour to occupy, if I did not feel the great responsibility under which I speak to you. The subjects with which we have to deal are not matters of mere speculative curiosity or intellectual amusement—to be taken up to-day, and dismissed perhaps with unconcern to-morrow—but they involve questions of life and death. The opinions you are now to form, or to accept, are for the most part the opinions upon which in after-life you will confidently and constantly be acting. The comfort or the misery of many families may probably hang upon the creeds that each of you will carry from this place. Therefore it is that I feel myself to be engaged in a very serious undertaking. Doctrines and maxims, good or bad, flow abroad from a public teacher as from a fountain, and his faulty lessons may become the indirect source of unspeakable mischief and suffering to hundreds who have never even heard his name. These thoughts fill my mind with an almost painful sense of the obligation imposed upon me by my present office, of closely sifting the facts, and meditating carefully the precepts, which I offer for your instruction and guidance.

But with all its responsibilities, both for teacher and for learner, the profession which you and I, Gentlemen, have chosen, or which circumstances have prescribed to us, is a noble profession, and worthy the devotion of a lifetime. If you fit yourselves now for its high functions, and pursue it hereafter in earnestness and truth, it will probably conduct you to an honourable competence, and it will assuredly prove a salutary school of mental and of moral discipline. Trials, no doubt, belong to it, and difficulties; but it has also privileges and immunities peculiar to itself. Affording ample scope and exercise for the intellect, it is conversant with objects that tend to elevate the thoughts, to temper the feelings, and to touch the heart. I have already reminded you how it brings beneath our minute and daily notice that most remarkable portion of matter, with which the human spirit is here mysteriously tabernacled, and which, apart from that singularly interesting thought, awakens increasing wonder and admiration the more closely we investigate its marvellous construction. The sad varieties of human pain and weakness with which our daily vocation is familiar, should rebuke our pride, while they quicken our charity. To us are entrusted, in more than ordinary measure, opportunities of doing good to our afflicted fellow-creatures—of showing love towards our neighbour. Let us beware how we idly neglect, or selfishly abuse, a stewardship so precious, yet so weighty. The profession of medicine, having for its end the common good of mankind, knows nothing of national enmities, of political strife, of sectarian divisions. Disease and pain the sole conditions of its ministry, it is disquieted by no misgivings about the justice or the honesty of its clients' cause; but dispenses its peculiar benefits, without stint or scruple, to men of every country and party, and rank and religion, and to men of no religion at all. And like the quality of mercy, of which it is the favourite handmaid, 'it blesseth him that gives and him that takes,' reading continually to our own hearts and understandings the most impressive lessons, the most solemn warnings. It is ours to know in how many instances, forming indeed a vast majority of the whole, bodily suffering and sickness are the natural fruits of evil courses—of the sins of our fathers, of our own unbridled passions, of the malevolent spirit of others. We see, too, the uses of these judgments, which are mercifully designed to recal men from the strong allurements of sense, and the slumber of temporal prosperity, teaching that it is good for us to be sometimes afflicted. Familiar with death in its manifold shapes, witnessing from day to day its sudden stroke, its slow but open siege, its secret and insidious approaches, we are not permitted to be unmindful that our own stay also is brief and uncertain, our opportunities fleeting, and our time, even when longest, very short, if measured by our moral wants and intellectual cravings.

Surely, Gentlemen, you will not dare, without adequate and earnest preparation, to embark in a calling such as this—so capable of good if rightly used, so full of peril to yourselves and to mankind, if administered ignorantly or unfaithfully. And even when you have made it, as you may, the means of continual self-improvement, and the channel of health and of ease to those around you, let not the influence you will thus obtain beget an unbecoming spirit of presumption; but remember that, in your most successful efforts, you are but the honoured instruments of a mightier power—that, after all, 'It is God who healeth our diseases, and redeemeth our life from destruction.'

LECTURE II.

Pathology—its objects. Pathology, general and special. Morbid alterations of the solid parts of the body. Alterations in size. Hypertrophy—laws of its production—its effects. Atrophy—its causes and consequences. Changes in form. Alterations in consistence. Induration—its various kinds.

PATHOLOGY investigates and seeks to interpret the material changes produced by disease, or constituting disease, in the various parts and organs of the body; the causes, and manner of occurrence, of these changes; and their consequences.

I shall devote two or three Lectures now, in the commencement of the Course, to a brief consideration of some prominent points in pathology, as thus defined. On many points our actual knowledge is still scanty and imperfect; what is best known and most useful, I shall place before you as distinctly, and in as small a compass as I can.

Pathology is general or special. General Pathology treats of the morbid conditions which are common to the entire bodily system, or to the whole of each of the several tissues that pervade and compose the system. Special pathology contemplates particular diseases. An acquaintance with General Pathology prepares us for, and conducts us to, that which is special; and when I say that the earlier Lectures of the Course will be given to a consideration of some of the leading facts and doctrines of pathology, you will of course understand me to signify *general* pathology.

I am about to speak chiefly of changes that manifest themselves to our unaided eyes, leaving unnoticed, for the present, those unnatural conditions which are cognisable only through the microscope.

The solid parts and organs of the body are subject to morbid changes in size, in shape, in consistence, in their intimate texture, and in their relative place.

So the fluid constituents of the body are liable to morbid alterations in quantity, in quality, and in place.

And many of these changes may exist in combination with each other.

Let us first consider the solids.

They may be simply altered in size without any change of texture; and that in two ways. They may become larger than is natural, or smaller than is natural. In the one case the change is called *hypertrophy*, in the other *atrophy*.

We find the best illustrations of hypertrophy in the muscular tissue. The huge fleshy masses visibly prominent in the arm of a blacksmith or a pugilist, and in the leg of an opera-dancer, afford familiar examples of it. In these particular cases the increased bulk, although it may be unsightly, as being out of proportion to other parts, is not disease, and does not interfere with the most perfect health. By frequent exercise the muscles acquire preternatural volume, and weight, and power. It seems to be a law which prevails extensively in the animal economy, that increase of function should lead to augmentation of bulk. The function of the muscular tissue is contraction, and more frequent and energetic contraction begets an addition of substance. But the same principle obtains in various other parts and tissues. It is especially noticeable in some of the glandular organs that are double. If one kidney wastes, or is spoiled by disease, an increase of function devolves upon the other, and by a beautiful law of compensation, the sound organ, without any alteration of its peculiar fabric, enlarges. The same is observed to be the case with the lungs. The law resembles, somewhat, one that is familiar to political economists, and is expressed by them in the maxim—that the supply of a marketable commodity is regulated by the demand for it. If, with respect to a muscle, increase of force be habitually needed, the necessity generates the requisite addition of bulk, which implies an augmentation of force. One kidney becoming inefficient, it is necessary that the other should secrete a larger quantity of urine; and this faculty is obtained by the enlargement of the secreting organ.

I say this law is of extensive operation in the living body: but it is not universal. It does not hold, for instance, with regard to the organs of the special senses. One eye does not become hypertrophic when the other is blind; nor one ear grow larger or longer because the other is deaf. And we see at once why the law in question should not apply in such cases. These organs differ from such as I mentioned before—from muscular and glandular parts—in this: that increase of their size would not promote or facilitate the purpose they are designed to serve. A muscular arm will strike a harder blow, and lift a heavier weight, in proportion to the greater bulk of its muscles: but we should gain nothing in distance or in distinctness of vision by the enlargement of an eye; nor should we hear more acutely or more clearly if our ears were of twice the ordinary magnitude.

Hypertrophy of this unmixed kind—unattended by any change of texture—(and it is to this that the term should as much as possible be restricted) depends upon increased nutrition of the part (ὑπὲρ τροφή). More materials are given up to the part by the blood, and assimilated, than are received back from the part into the blood, to be taken out of the body. The nutrition exceeds the waste. That hypertrophy does thus result from an excess in the process by which parts are nourished and built up, and not from a defect in the process by which they are continually unmade and removed, is confirmed by the fact that an increased quantity of nutrient blood is sent to the part hypertrophied. Its arteries grow larger. This we perceive by comparing these vessels with others where no accession of bulk has occurred. This view is further strengthened by the converse effect produced upon an hypertrophied part, the thyreoïd gland for instance, by tying its principal nutrient artery. The magnitude of the bronchocele diminishes. It is curious that it should still be a matter of debate among Pathologists, whether the nerves of the part partake also in its enlargement.

Now these examples of hypertrophy clearly have not the nature of disease. But hypertrophy is often plainly connected with disease, while still it is not itself a morbid process. Thus we have it in the hollow contractile organs, the office of which is to propel fluids:—in the heart when the progress of the blood suffers some mechanical impediment; in the bladder and in the intestinal canal, when their respective contents are somehow hindered in their natural course; or when, from some undue stimulus or irritation, these parts are urged for a long time together to excessive, or too frequent, action. I show you preserved specimens of all of these changes. You will find that muscular tissue may become apparent, under the influence of disease, where very slight traces of it, or none at all, were visible before. We sometimes observe this in the air tubes, the trachea and bronchi, when the respiratory functions have been long embarrassed; in the gall-bladder, when the exit of the bile has been chronically obstructed; and in the small arteries, under morbid conditions to be hereafter explained. And it is worth remarking, that this seemingly new, or greatly exaggerated appearance of muscular tissue, which is the consequence of disease in the human body, is analogous to the natural and healthy structure of the corresponding organ in some of the inferior animals.

The several instances of hypertrophy that I have now been mentioning, if they are to be looked upon as morbid, are morbid in a particular and limited sense—morbid, merely as being associated with disease, but not so either in their own processes or in their tendencies. Many indeed of the writers who have noticed them, speak of the hypertrophy as constituting a source or form of disease, and a cause of danger to the patient. But I shall have occasion to show you hereafter, that in most cases it is really a compensatory change, and conservative of life;—a resource of nature by which impending danger is postponed, and existence prolonged.

It may be said of hypertrophy, that its relation to disease depends very much upon its seat. As regards the muscular tissue—in the voluntary muscles it is generally innocent, in the involuntary it is generally connected with disease; sometimes, as a cause, much oftener as a remedial consequence, sometimes as both cause and consequence. One way in which hypertrophy may manifestly be a cause of disease is by the pressure of an enlarged organ upon the parts in its neighbourhood, and a consequent interference with the functions or the sensations of those parts.

I am not sure whether, to those among you who are beginners, I make myself understood. An example or two may render my meaning plainer.

It often happens that the aortic orifice of the left ventricle of the heart becomes narrow and constricted, in consequence of disease in the semilunar valves there situate. Under these circumstances, it is requisite, for the due propulsion of the obstructed blood, that the ventricle should contract with increased force. Its walls accordingly become thicker and stronger. Here the hypertrophy of the left chamber is evidently a consequence or *effect* of the disease that previously existed at its outlet.

On the other hand, when the thyreoïd gland is enlarged, it sometimes presses so much upon the parts that lie behind it, as to impede the breathing, or the swallowing. In this case, the hypertrophy is the *cause* of consecutive disease.

Hypertrophy is exceedingly common in other tissues as well as in the muscular. Of its affecting the glandular system we have good examples in what I have just mentioned, the true bronchocele; in certain forms of enlarged prostate; in the thymus gland not unfrequently; and in the tonsils. Of a state of the brain which is thought to constitute hypertrophy, I shall speak more particularly when we come to the morbid conditions of that organ. Hypertrophy is also said (I am not certain with how much propriety always) to occur in the cutaneous and mucous systems, in the bronchial, mesenteric, and mammary glands, in the liver, spleen, and pancreas. Of these parts I suspect that the enlargements to which the term hypertrophy has been sometimes applied, most frequently combine some alteration of texture with the increase of size, and therefore are not examples of pure hypertrophy.

You ought to be aware that hypertrophy of one or more of the component tissues of an organ may exist, while the others either remain unaltered, or are changed in some other way. It frequently happens that when one component part is thus over-nourished, it is so at the expense (as it would seem) of another which becomes atrophied. There are parts of the heart upon which a certain quantity of fat is usually deposited. We sometimes meet with this fat in excess, and at the same time find the muscular texture of that organ pale, flabby, soft, and wasted. What has been deemed hypertrophy of the female breast consists, almost always I believe, in excessive development of its adipous tissue, without any enlargement of the gland itself—or even with its diminution.

Hypertrophy of the adipous tissue is often general throughout the body, producing obesity; and this may become so extreme as to amount to disease, when it is called by nosologists *polysarcia.* I have seen one fatal instance of this kind: perhaps two. The mother of a large family, whom I long knew as a slender and elegant woman, began suddenly to grow fat; and in about fifteen months, without any other discoverable malady, she gradually enlarged into a corpulent unwieldy monster. At length her legs and thighs became œdematous as well as fat, her lips blue, her breath was short, and her pulse feeble. One night she was found dead in her bed. The body was not examined; but her death was mainly owing, as I believe, to fat collected upon the heart, oppressing its movements, and at last stopping them altogether.

In the majority of cases the bulk of an hypertrophied organ is augmented; it has a larger superficies than is natural: and therefore I have introduced hypertrophy to your notice among the alterations to which parts are liable in *size*.

But it is not always so. There may be hypertrophy of an organ without enlargement—in at least three different ways:—

1st, In hollow organs, where the additional substance is deposited centrically, and the hypertrophy takes place at the expense of the cavity:

2ndly, In any organ, whereof the hypertrophy is confined to one or more tissues, while the others are proportionably wasted: and,

3rdly, Hypertrophy may even be consistent with no alteration of shape, or increase of bulk in any direction, the organ occupying exactly the same space and preserving the same absolute dimensions as before, but becoming more full of component particles, more compact, heavier. This state is well exemplified in certain cases of hypertrophy of bone: the spongy or cancellous texture of the bone disappears; its specific gravity is increased; it becomes hard, firm, and like ivory. The structure appears, to the eye, to be changed, yet remains the same, except in respect of its density.

I have told you that hypertrophy is usually a conservative and salutary change. We shall meet with many illustrations of this as we proceed. But I may take the present occasion for pointing out to you some of the beneficial tendencies of this change when it takes place in bone. For, since the diseases of the bones do not belong to my province, I may have no other opportunity.

You probably know that in the disorder called rickets, occurring principally during childhood, the bones are soft and deficient in their more solid ingredient; so that they bend under the weight of the body, or the contraction of the muscles attached to them. After a certain period this disproportion in the constituent particles of the osseous tissue ceases; but the bones are permanently distorted, and, therefore, less adapted to their office, and less strong, than if they had remained straight. Now the natural remedy that ensues is very striking and beautiful. The bent bones become *hypertrophied* in certain places; they grow thicker, denser, harder, and consequently stronger, at the very concave part where the stress of the pressure is the greatest.

The following experiment showed the same thing in a somewhat different manner. An inch of the middle part of the fibula of a quadruped was cut out. A long time afterwards the animal was killed. The tibia was then found to have become considerably larger exactly in that part of it which corresponded to the defect in the fibula.*

The same principle appears still more conspicuously in a case of disease related by Cruveilhier. He saw in the hospital at Limoges a young man who had lost (from necrosis with suppuration) the middle third of his tibia; of the larger of the two bones of the leg. The lost bone had not been reproduced, but the fibula, the naturally slender bone, had become thick and strong enough to support the whole weight of his body.

I was explaining to you that hypertrophy may exist, without enlargement. On the other hand there may be enlargement, without any change of structure, and yet no hypertrophy. The liver and spleen are apt to acquire a considerable increase of bulk from mere congestion and distension of their vessels by blood. An immense spleen will shrink into its proper size in a few hours, after hæmorrhage from the stomach, whereby the gorged venous system of the abdomen has been relieved. Dr. Townshend mentions a remarkable example of the same kind respecting the liver. The inferior cava had been compressed by an aneurismal tumour, so that the passage of the blood from the liver was greatly impeded. Under these circumstances the liver became so large as nearly to reach the crest of the ilium. Suddenly the aneurism burst, the pressure was taken from the cava, the hepatic veins were allowed to empty themselves, and before the body was opened for inspection, the liver had nearly resumed its natural situation and dimensions.

In the profound, yet clear and instructive views of this subject set forth by Mr. Paget in his lectures before the College of Surgeons, the conditions which give rise to hypertrophy are stated to be chiefly, or only, three, namely:

'1. The increased exercise of a part in its healthy functions.

'2. An increased accumulation, in the blood, of the particular materials which a part appropriates in its nutrition, or in secretion.

'3. An increased afflux of healthy blood.'

In the hypertrophy of the muscular tissue the first and third of these conditions coincide. The more frequent and vigorous contractions of the muscle accelerate the passage of the blood through its vessels, and so increase the quantity which flows towards and into them in a given time. The enlargement of the nutrient arteries is secondary to the hypertrophy; and in turn contributes to sustain and augment it.

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* Mr. Stanley's Lectures, Coll. Surg.

But the increased afflux of blood may be primary. Of this Mr. Paget adduces instances, in the growth of rank hairs around the edges of sores which have continued long inflamed, and about old diseased joints; in the rapid increase of the spur of a cock when transplanted from the bird's leg to its comb; and (probably) in certain cases of congenital or spontaneous hypertrophy of a single member, of a hand or a foot, or of one or more fingers.

When one kidney augments in size upon the destruction or inaction of the other, we have coincidence of the first and second conditions. Mr. Paget thus explains the process. 'The principal constituents of the urine are, we know, ready formed in the blood, and are separated through the kidneys by the development, growth, and discharge of the renal cells, in which they are for a time incorporated. Now when one kidney is destroyed, there must, for a time, be an excess of the constituents of the urine in the blood; for since the separation of the urine is not mere filtration, the other kidney cannot at once, and without change of size, discharge a double quantity. What then happens? The kidney grows, more renal cells develope, and discharge, and renew themselves. In other words, the existence of the constituents of the urine in the blood that is carried to every part, determines the formation of the appropriate renal organs in the one appropriate part of the body.'

In the same manner the increased formation of adipous tissue may be ascribed to the presence of abundant hydro-carbon principles in the blood, which are the chief elements of fat.

A few isolated facts, bearing upon some points connected with this enquiry, may be worth mentioning.

In the first place, certain places appear to be influential in the production of certain forms of hypertrophy. Thus bronchocele is very frequent among the inhabitants of certain districts; especially in close or marshy valleys at the feet of high mountains. Its real cause is to be sought in some condition, hitherto undetermined, of the air in those places, or more probably of the water, or of both.

2ndly, Certain congenital or acquired conditions of the system, tend to produce local hypertrophy. In that peculiar diathesis which we call the strumous—and of which I shall have much to say hereafter—certain parts of the body, as the upper lip, and the extremities of the long bones, undergo a kind and degree of enlargement that seems properly to fall within the definition of hypertrophy.

3rdly, Certain habits of life have a distinct effect in promoting certain forms of hypertrophy. A full diet, with bodily inactivity, leads to hypertrophy of the adipous tissue. So general is this tendency, that we confidently act upon it in the fattening of animals. Shut a healthy pig up in a small sty, and give him as much food as he is willing to eat, and you ensure his rapid pinguescence. If you cannot so certainly attain the same result by similar means in the human animal, it is chiefly, I believe, because moral causes, and especially mental anxiety, will effectually counteract those means. A healthy man, with a quiet mind, using habitually a full nutritious diet, and leading a sedentary life, will fatten, I apprehend, as unfailingly as a calf or a turkey. Sometimes, indeed, fat accumulates, to an enormous extent, in spite of abstinent habits, and very active exercise.

To this subject of obesity I probably shall not recur. I will, therefore, say now that of the two influences just referred to, diet and exercise, when opposed to each other, diet is the stronger. There was living some years ago near Newmarket a publican who indulged himself immoderately in eating and drinking. To keep the results of this intemperance in check, he took a great deal of exercise, and twice a week he swallowed two ounces of Epsom salts, which always had the effect of making him more hungry. He grew to be prodigiously large and fat, and weighed 392 pounds, or 28 stone.

This man failed in his business; and in one year from that time was reduced, under hard work and harder fare, to the weight of 14 stone, with no suffering whatever to his health. He had hoed three quarters of an acre of turnips on the day when he was last seen by a friend of mine, who had witnessed and watched this remarkable transformation.

Again, the *kind* of food has much more to do with the production of obesity than the *quantity*. In his widely read pamphlet on Corpulence Mr. Banting has well exemplified this. He tells us that, after struggling in vain for years against constantly augmenting fatness—in spite of gallons of liquor potassæ and other physic, in spite of Turkish baths to the number of ninety, in spite of hard muscular work, such as rowing a heavy boat for two hours every morning, which only increased his appetite—he found himself at last so encumbered by fat that he could not stoop to tie his shoes, was compelled to go downstairs slowly backwards, to wear bandages around his knees in order to support his over-weighted joints, and was molested by the jeers of those who passed him in the streets. In this unhappy plight, after suffering many things from many physicians, he got at last from Mr. Harvey the sensible advice, that he should abstain as much as possible from fat or fat-making articles of diet—from starchy therefore and saccharine matters, from the hydrocarbons in short. Thereupon he almost abandoned the use of bread, butter, milk, sugar, beer, and potatoes, eating freely however and fully of other kinds of food. In this way he gradually lost, in about a year, forty-six pounds in weight, and improved wonderfully in his general health, comfort, and symmetry; and the improvement was permanent. I quote one sentence from his charitable and amusing paper: 'I can now confidently say that quantity of diet may be safely left to the natural' appetite, and that it is the quality only which is essential to abate and cure corpulence.'

4thly, It is a curious fact that the removal of certain parts of the body, as the testicles from male animals, and the ovaries from females, increases the disposition to accumulate fat. The same tendency appears to be given, for a time, by the extirpation of the spleen.

Of the curative methods that hypertrophy may require it would be premature to speak at present.

The *size* of parts may be also *augmented* in various other ways. The hollow organs may be inordinately distended by an undue accumulation of their natural contents; or by matters that do not enter them in health. The solid organs may have their size increased by the presence of matter foreign to their natural composition, collected in their interior, or distributed through the interstices of their proper tissues, or deposited upon their surface: and in either case the functions of the part itself may be disturbed or suspended; or the functions of parts immediately contiguous to it may sustain damage from its pressure; or the functions of distant parts connected with it by dependency of office may be disordered; or all these consequences may ensue together. Numerous examples of them all will hereafter be brought under your notice.

Let us next attend to that condition which is the opposite of hypertrophy—to *atrophy*, namely, in which parts become notably smaller than natural, without other alteration of texture.

The two conditions contrast strongly with each other in their nature and origin, as well as in their physical characters.

Hypertrophy depends essentially upon an increase—atrophy upon a diminution or defect, of the nutritive functions. You will find that atrophy plays an important part in altering the bodily organs, both in health and in disease.

Of the effect of atrophy in causing alterations consistent with health, I shall merely remind you of some instances, that you may the better comprehend its morbid operation.

There are parts of the body, as you well know, destined to a temporary purpose only. Upon the cessation of their especial function they dwindle, or disappear. We have examples of this in the thymus gland, and in those parts of the mechanism of the circulation which are peculiar to the fœtal state. The atrophy here begins as soon as the child is born, and is not only consistent with, but necessary to, its perfect health. As life advances, we see the same principle at work, remodelling from time to time those structures of which the office has only a limited duration. After the child-bearing period in women is over, when the functions of the ovaries expire, these organs shrink, through atrophy. It is so with the testes of old men. Indeed, atrophy, to a certain extent, pervades all parts of the system in old age: the muscles diminish in size, the whole body is less plump, the bones lose a portion of their substance, and become brittle.

Even in the period of fœtal life this process, by which parts are starved and stunted, sometimes displays itself. But here it is no longer compatible with the integrity and well-being of the system. The arrest or retardation of the nutritive function produces changes of great interest, and gives rise to various kinds of deformity. Harelip—fissure of the palate—certain malformations of the heart—are familiar examples of the consequences of intra-uterine atrophy.

Atrophy, considered as a morbid change, is conspicuous, no less than hypertrophy, in the muscular tissue. We see it in the voluntary muscles, whenever a limb remains long in a state of inaction—whether from palsy depending upon disease in the brain or spinal cord; or from pain connected with disease of a joint; or from perversion of the will, as in the self-inflicted penance of the Fakir. The same law, therefore, obtains here, which was previously announced; the development of a part is proportioned to the activity of its function. In most cases, I believe, the atrophy will be found to resolve itself into a deficient supply of healthy arterial blood. Building materials are not provided, or are provided inadequately. Mere inaction will produce atrophy; but it is probable that the inaction operates simply by abridging the flow of arterial blood to the muscle. If (as I believe) what is called a *change in the innervation* of a part tends sometimes to occasion its atrophy; if, for example, the altered state of the nervous influence has some share, beyond the inaction which it produces, in causing the atrophy of a paralysed limb—it still acts, I conceive, indirectly, and by reducing somehow the supply of healthy arterial blood. The nerves belonging to palsied and atrophied muscles are found to diminish in size. It is with the arterial circulation, however, that atrophy is most concerned. It is upon a diminution of the number of the smaller, and perhaps also of the capacity of the larger arteries, that senile atrophy often depends. We find atrophy of the brain accompanying certain diseased conditions of its main arteries. So the testicle withers when the spermatic artery is tied for the cure of varicocele.

Take notice how the laws of atrophy and of hypertrophy tally also in their exemptions, and are alike inapplicable to the organs of the special senses. I showed you that, although a kidney grows larger when the function of its fellow gland is lost, it is not so with an eye. Neither does the eye dwindle under mere disuse. Of this we have a remarkable illustration, as Mr. Simon has pointed out, in the boy who, born blind, was couched at the age of fourteen by Cheselden. His organs of vision were perfect in function and in bulk, after the almost total suspension of their office for so many years.

Pressure of any kind, permanently exercised either upon the large arterial trunks, or upon the capillary vessels, so as to lessen without completely preventing the supply of blood, will be found to give rise to atrophy, whenever the due quantity of blood is not furnished by the establishment of a collateral circulation. I say *permanently* exercised, because intermittent pressure has often the exactly contrary effect. It was a maxim of Mr. Hunter's, that pressure from without produces thickening; pressure from within thinning and absorption of parts. Of the former we see an example in the thickening or hypertrophy (*conservative* hypertrophy) of the cuticle on the soles of the feet in persons who walk much, and on the palms of the hands of those who labour with tools. But Mr. Paget has superseded this principle by one of wider extent and of more exact application. He has shown that it is not upon the direction of the pressure that its different results depend; but upon the circumstance of its being constant, or only occasional, whatever may be its direction. 'All the thickenings of the cuticle are the consequences of occasional pressure—as the pressure of shoes in occasional walking, tools occasionally used with the hand, and the like; for it seems a necessary condition for hypertrophy, in most parts, that they should enjoy intervals in which their nutrition may go on actively. But constant pressure, whether from within or from without, always appears to produce absorption.' He does justice to Mr. Hunter's sagacity, however, by remarking, that 'nearly all pressures from without are occasional and intermittent, and nearly all pressures from within, arising as they do from the growth of tumours, the enlargement of abscesses, and the like, are constant.'

Chronic Inflammation is sometimes attended by the wasting of the part which it occupies. It acts, in all probability, by unfitting the minute arteries for transmitting the requisite quantity of blood. Various diseases, by which the supply of nutriment to all parts of the body is checked at its source in the digestive organs, or by which some unnatural drain upon the system is kept up—by which, in short, the quantity of the nutrient fluid is diminished, or its quality impaired—produce a greater or less degree of *general* atrophy; but to this universal wasting we usually apply the term *emaciation.*

Atrophy, then, such at least as is morbid in its nature, may be the consequence of inaction, of abiding compression, of chronic inflammation, and of various diseases; but in all cases the defect of nutrition which constitutes the atrophy seems to be resolvable into a diminished supply of healthy blood through the arteries.

As in hypertrophy, so likewise in atrophy, the change may be limited to some one or more of the component tissues of a part:—and by these altered proportions of its constituent tissues the appearance of the part may be remarkably modified.

So also, as hypertrophy may exist without any increase of absolute size, atrophy may occur without any decrease: as in the heart, when the cavities are dilated in the exact degree in which their walls become thinner. Bones, externally sound in appearance, have had their specific gravity so greatly reduced by internal atrophy, that they would float, like a cork, upon water.

It is a curious fact—which I mentioned in other terms before

—that an atrophied part is sometimes plentifully encompassed by fat. But this is by no means a necessary accompaniment. Why it happens in one case, and not in another—whether the adipous hypertrophy is ever the cause of the atrophy associated with it, or the atrophy the cause of the hypertrophy:—these are questions which, in the present state of the science of medicine, do not admit of any positive solution.

It is scarcely necessary to observe that the changes of *bulk* which we have been considering, imply often, though not always, changes of *form* also. You may have one or two of the chambers of the heart greatly enlarged, while the others remain of their natural size. Of course this altered proportion modifies the shape of the organ.

Signal changes of form are produced also by inflammation, by pressure, and in various other ways. But, after all, modifications of figure are rather to be considered as *accidents* of disease than among its important *elements*; and I pass on to other alterations.

Various parts of the body are liable to be changed in *consistence*. They may become harder and firmer than before: or they may become softer. To the state of increased or unnatural hardness the term *induration* has been applied; the same word is used also to express the process of hardening. To the state of diminished consistence we give the name of *softening*. The French pathologists, who first noticed this condition as an element of disease, call it *ramollissement*.

You are already aware— those of you who have attended the lectures of the professors of midwifery and of anatomy—that a slow process of natural and healthy induration is going on throughout the body from the earliest period of uterine life to extreme old age.

There are several ways in which *un*natural induration may take place.

Induration of an organ may happen, without any other alteration of its proper tissue, in consequence of inordinate fulness of its blood-vessels. This is apt to occur in the lungs, or liver, whenever the free exit of the blood from these organs is in any way impeded. They become stretched, tense, resisting, hard.

In like manner induration of the hollow organs, or of cellular parts, may arise (without any change of their texture) from an undue accumulation of fluids within them:—of bile, for example, in the gall-bladder; of urine, in its receptacle; of gases in the stomach and intestines; of serosity in the cellular tissue.

In either of these kinds of induration the unnatural hardness may be temporary only, or it may be the permanent accompaniment of other disease. It is necessary that you should be aware of its occurrence, and of its nature. I say, of its *nature*, because this is not always understood. In the induration arising from the last circumstance I mentioned, viz., from infiltration of the cellular tissue with the serous or albuminous parts of the blood—from *œdema*, in short—the hardness has sometimes been erroneously ascribed to some other morbid condition. Dr. Carswell has shown that in the curious disease of new-born children who are said to be *skin-bound*, the hardness of the surface is the consequence of simple œdema of the subcutaneous cellular tissue. The same phenomenon is remarkable in œdema of the tongue. I believe the induration belonging to œdema will be found to be the greater, in proportion as the effusion is large and recent, and has taken place rapidly.

Again, induration may accompany, and be a consequence of, simple hypertrophy. Of this I have already shown you examples: especially in the eburnation (as it has been called) of hypertrophied bone.

Induration of an organ may also result from the *ex*pression of its fluid, and the *com*pression of its solid parts. We see this extremely well in the lung, when it has been thrust and flattened against the vertebral column by fluid effused into the pleura; or when it is still more tightly bound down by an investing layer of plastic lymph. In this way, therefore, induration may be consistent with atrophy. That the natural structure of the hardened lung is not always lost in these cases we know, because we can restore, to a certain extent at least, its bulk and spongy feel, by gently and gradually inflating it. The spleen sometimes exhibits the same kind of induration, under the constrictive force of an investing false membrane. I am mentioning samples only of these changes.

More frequently induration depends upon the presence in the internal texture of parts, in the little spaces left between their component tissues, of fluid or solid matters which are not found there in the healthy state. Bony or earthy particles are sometimes laid down, and the part thus changed is said to be ossified. There are few parts of the body in which this kind of induration does not occasionally take place. It is especially common in the coats of arteries, and in the subserous tissues. Blood, or fluids separated from the blood, may fill and obliterate the natural interstices, and concreting, tend to consolidate and harden the part which they occupy. What is called hepatisation of the lung is a good instance. I need not tell you that the healthy lung is spongy and crepitant under pressure; in this altered state it no longer crackles between the fingers; its spongy character is lost; it resembles liver in its compactness and colour, and it is therefore said to be 'hepatised.' This is a consequence of inflammation; and induration of this kind is a very common consequence (as we shall see) of the same morbid process in various other parts and organs. Another instance of induration of the pulmonary substance we have in what is badly named pulmonary apoplexy. This is independent of inflammation. Blood is collected and coagulates in a part of the lung which should contain air—in the vesicles of one or more of its lobules; the lobules thus gorged with blood become even harder and firmer than when hepatised; but by a different process.

In the instances last mentioned, fluids after escaping from their proper vessels, *i. e.*, in technical phrase, after being *extravasated*, pass into the solid form, and thereby render the parts which they pervade harder and more firm. But fluids may concrete and harden *within* their proper vessels, and so lead to another form of induration. Thus the blood, under certain circumstances, coagulates in the living veins—nay, sometimes even in the heart itself: and we may hereafter have to consider the conditions under which this coagulation is liable to occur, and the serious consequences which it involves. The bile again, as you probably know, sometimes concretes, by a rude kind of crystallisation, into what are called gall *stones*: and the passage of these calculi through the narrow ducts that connect the gall-bladder with the bowel is apt to be attended with pain the most intense. The formation of *urinary* calculi is not exactly of the same kind.

Numerous specimens of all the changes I have been describing are on the table before you. You may examine them at leisure after lecture, or in the museum.

I have yet to notice another source of unnatural induration, in the deposition or growth of irregular masses of matter within the body, differing remarkably from any of the solids or fluids that enter into its healthy composition. These unnatural formations vary considerably in their nature and appearance, and in their consistence, at different periods. Sometimes they exist in distinct and separate masses, and whether hard or soft in themselves, cause induration by their pressure upon surrounding textures; sometimes they are diffused through or among the natural tissues of a part, which thus they indurate. All the varieties of tubercle, and of cancer, all those forms of disease which have been styled malignant, fall under this head.

These new and morbid products play a fearful part in disorganising the bodily frame, and in embittering and shortening life. They will necessarily occupy much of our attention in the progress of the course. At present I merely point them out as illustrations of the manner in which the consistence of parts may be *increased*.

LECTURE III.

Softening; its causes and varieties. Transformations of Tissue. Changes of situation—in the Chest, of the Lung, of the Heart—in the Abdomen and Pelvis, Hernia, Intus-susception, Prolapsus.

We were occupied with that branch of pathological enquiry which relates to the various ways in which the several parts and organs of the living body are liable to be sensibly altered by disease.

We considered the changes to which the solid parts are subject in *bulk* and in *form*; and that alteration of their consistence which constitutes hardening or *induration.*

The opposite condition to this is *softening*, diminished consistence, a less degree of cohesion of parts and tissues than is natural.

This also is a change of which it is important that you should comprehend the nature, and causes, and varieties; and the share that it often has in breaking down the structure of organs, and in destroying life.

There is scarcely any tissue of the living body, in which softening may not take place. I shall here, however, as before, mention a few illustrations only of its occurrence, taking those instances in which the phenomenon is most evident, or is best understood.

Softening is perhaps never more strikingly obvious to our senses than when it affects the brain or spinal cord. We find portions of these organs manifestly softer than the rest. You are familiar with the usual consistence of the adult brain: you will find it sometimes reduced, in places, to the consistence of cream: a gentle stream of water suffered to fall upon the softened pulp suffices to wash it away, and a cavity is left in its place.

The cellular tissue—or let us rather call it, with Professor Todd, *areolar* tissue, since minute anatomists now affirm that *all* the tissues in their embryonic state are *cellular*—the areolar tissue is another part in which softening is exceedingly common, although the change is not so readily perceived. This is the great connecting tissue of the body; and we are made sensible of its diminished consistence, when parts which it unites become separable with unusual ease. Thus you may sometimes, by exerting a very slight degree of force, strip off a serous membrane from the parts which it invests, or a mucous membrane from the surface lined by it. This ready separation is a consequence of the diminished consistence of the subserous, or the submucous, areolar tissue. The membranes themselves, in such cases, may be in a perfectly natural state.

Muscles, again, are often palpably softer than they should be; the fleshy substance of the heart, for example. Here the muscular fibre may itself have undergone a change of consistence; or the muscle may simply appear to be softened, in consequence of the softening of the threads of connective tissue by which its fibres are tied together.

The mucous membranes very frequently present the phenomenon of softening. This is more commonly seen in the stomach than elsewhere. Instead of being raised from the subjacent tissues in large flakes, the mucous membrane, when seized between the blades of a forceps, breaks off in small fragments; or it may be crushed and mashed by the pressure of the finger, or washed away in shapeless pulp by a little current of water. This condition of its lining membrane is usually limited to parts of the stomach; but occasionally it is general.

Even the bones are liable to this change of consistence. There is a disease called *mollities ossium*, in which the bones even of adults become soft and pliant, and capable of being bent in any direction. Upon what these altered qualities are believed to depend, I will explain to you presently.

The accidental products to which I adverted when speaking of induration—especially some of the varieties of cancer—are sometimes remarkably soft, resembling brain in consistence and appearance, or cream, or jelly. But in these cases we can scarcely consider the change as an example of softening of the textures of the body; it rather consists in the addition of parts that are themselves soft and half fluid.

Now softening may occur under very different circumstances. One very general cause of softening is inflammation. Every part, I believe, that is inflamed undergoes, in the first instance, a diminution of its consistence, its particles lose their cohesion. This appears to be almost the necessary consequence of stagnation of the blood, the effusion of serosity, and the suspension of healthy nutrition. These are circumstances to which I shall recur. I cannot avoid alluding occasionally to things with which you are supposed to be as yet but little acquainted, and which will engage our particular attention as the course advances.

It would be a great mistake, however, to imagine that all softening results from previous inflammation. Doubtless it often proceeds directly and simply from deficiency of nutrition, and is then closely allied, as I said before, to atrophy. Thus softening of the brain is, sometimes, due to inflammation: we meet with it where the inflammation has been unequivocal, and was caused by external injury; but sometimes also it is quite independent of inflammation, and is owing to disease or obstruction of the cerebral arteries, whereby the brain, or a portion of it, is deprived of its full supply of arterial blood, and ceases to be properly renovated. Hence a loosening of its texture, a separation of its component particles, an approach to the fluid state. I shall, of course, hereafter endeavour to point out to you more particularly the means we possess of distinguishing these two forms of cerebral softening. They constitute morbid conditions of the highest interest.

I may observe, that we have an illustration of the principle now laid down, in that general softness, flaccidity, and slight cohesion of parts, noticeable in children, and others, who are imperfectly nourished. We find this general absence of the natural firmness coincident with paleness, and a thin watery condition of the blood. Magendie kept animals upon food unsuitable for them, containing no azote, and incapable of supplying sufficient nourishment; and one curious consequence was a loss of substance in the cornea, which melted down and disappeared.

There is another source of softening which requires to be mentioned—I mean the gastric juice, which has the power of dissolving not only food that is submitted to its action, but the mucous membrane of the stomach itself, and even all its tissues and coats. This cause of softening operates, however, in the dead body only; but its effects have often been mistaken for the consequences of disease; and therefore it will be necessary for me hereafter to call your attention to the circumstances under which those effects may be looked for, and to the points of distinction between them and other changes that are more properly called morbid.

Upon the whole, it may be said that every form and kind of softening in the living body—whether it proceed from inflammation, from disease or obstruction of the arteries, from insufficient sustenance, or from altered qualities of the blood—may ultimately (like atrophy) be resolved into suspended or defective nutrition.

Furthermore, as there is a hardness of parts resulting from repletion and distension, so there is a *softness* rather than a *softening*, from their emptiness and flaccidity: as of the breast immediately after the child has sucked; of the abdomen soon after delivery; of the integuments in those who, having been fat, have wasted, either from disease or from advancing age; and so on.

On former occasions, I thought it right to lay before you the views of M. Andral (which appear to have been adopted by Sir R. Carswell also) respecting what has been called the *transformation of tissues*. 'In the proper place of one natural tissue (I remarked) we sometimes find another, which last is thus *un*-natural in regard to its situation, but natural in all other respects. The new tissue is such as we meet with elsewhere in the body, but it is not such as properly belongs to the place it occupies. Either the original tissue has been gradually converted into the new, or the original tissue has disappeared, and the new tissue has been substituted for it: that, for example, which should be cartilage we sometimes find to be bone.'

'In most cases the tissue that has been changed or displaced is in one of the two following predicaments:

'Either its natural function has been for a long time suspended;

'Or, it has been accidentally called upon to fulfil a purpose for which it was not originally designed.

'In the former case it gradually approximates towards areolar tissue, which at length is all that remains.

'In the latter it assumes the characters of that other tissue of which it has taken up the office.'

Now the analogy which M. Andral thought he could perceive between changes of this kind, and the changes that occur during the growth and progressive development of the human body, does not in reality obtain. More recent and more exact microscopical researches have shown that the several tissues do not commence by being connective tissue, and therefore that in the dwindling of any given tissue into the connective, there is no return, as M. Andral had supposed, towards the primitive state of the tissue so wasting. A muscle remaining for a long time in complete inaction, loses bulk, but does not pass from the condition of muscular into that of connective tissue. When wasted to the utmost it may still retain its proper anatomical elements. The areolar tissue is quite as complex and advanced a tissue as the muscular. There is no true conversion of the one tissue into the other. It is commonly stated, indeed, that when a muscle comes accidentally to invest a dislocated joint, the dislocation remaining unreduced, it assumes by degrees the character, together with the uses, of those tissues which naturally inclose the joint, and is *converted* from muscular into fibrous or ligamentous tissue—just as in the vegetable kingdom, the cut end of a willow *branch*, planted in the earth, takes up the office, and gradually acquires the form and properties of a *root*. But here again the analogy is more fanciful than real. The formation of a false joint implies no actual conversion of tissues. The muscular fibres shrink and disappear, while the areolar tissue augments, and is *transformed* only into the fibrous; these two, the fibrous and the areolar, being essentially and primarily the *same* tissue.

The change from cartilage to bone approaches more nearly than any other to actual transmutation; but even this resolves itself into a simple increase of one of the natural constituents of both the tissues concerned—phosphate of lime, which exists in healthy cartilage.

I spoke of local and of general additions of adipous tissue occurring in the body, as forms of hypertrophy. But fat is apt to be produced, by a sort of transformation, in atrophy also. Mr. Paget indeed, whose remarks on this subject possess a very high interest, makes fatty degeneration to be one kind of atrophy. He describes atrophy without change of texture, (in which sense I have been using that term,) and atrophy with degeneration of texture. Although there is no necessary connection between them, the two often exist together, but one of the two predominates. The degeneration proceeds under the ordinary conditions and causes of simple atrophy; and it is a common result of that imperfection of the formative process which accompanies the infirmities of old age.

In this form of atrophy the fatty matter is not deposited, as in hypertrophy, from the blood-vessels, and laid up in cells or vesicles; but it is apparently the result of some chemical change wrought in the affected tissue itself, throughout which the molecules of fat are irregularly distributed. It is a process and a mark of dilapidation; the most common way in which the bodily frame begins to decay, when life is on the wane. It is met with in unexercised voluntary muscles, whether their action be suspended by paralysis or by the immobility of the part, which it is their function to move. It occurs under the deteriorating influence of disease, or of age, in that involuntary muscle the heart; in the arteries, of which the muscular element is probably the first to suffer; in the bones; in the cornea, where it becomes visible even during life as the *arcus senilis*; and in various other organs of the body. What is called the fatty liver is an example. The altered liver is larger than natural, of a light tawny colour, of diminished specific gravity, retains the impression of one's finger, is tender, and tears easily: it greases the knife that cuts it, or bibulous paper in which it is wrapped. By boiling it you may obtain a concrete oil, which has all the characters of fat. Under the microscope, the molecules of fatty matter are recognised, in this and in other tissues, by their peculiar refraction of light. They sometimes run together into larger unequivocal oil-drops. Chemistry detects their nature by their solubility in ether.

What is very curious in respect of this morbid condition of the liver is, that we can produce it, at will, in some at least of the lower animals. You know that the '*foie gras*,' procured from certain birds, is an article of great luxury among epicures. It is obtained by a very cruel process. Geese, or ducks, are confined in baskets just large enough to contain them, but not large enough to allow them any movement: they are kept continually in the dark also; sometimes even, I am afraid, their eyes are put out, but this I should imagine to be a useless and superfluous piece of cruelty, it being the absence of light, and not the absence of the power of vision, which helps to bring about the desired effect. At the same time the birds are sedulously crammed with food. Under this discipline their livers acquire the requisite size, and greasiness, and the true flavour.

The history of these unfortunate fowls is not barren of instruction with respect to the more limited bad effects of full diet, want of exercise, and a short allowance of daylight, upon the 'featherless biped' man.

You will take care not to confound hypertrophy of the adipous tissue with fatty degeneration of the muscular or other tissues. There are strong contrasts between them; yet they sometimes coexist. Persons whose adipous tissue is enormously developed may nevertheless be muscularly strong, may even be extremely brisk, active, and agile. But theirs is an unsafe condition. More often they are dull and heavy in mind and body, and they readily succumb under attacks of acute disease. Strength is never found associated with fatty degeneration; which may arise and go on in men or women who are also generally fat; while it frequently appears in connection with emaciation, and wasting illnesses—in phthisis for example.

Fatty degeneration affecting the muscular substance of the heart, and rendering that main instrument of the circulation soft, weak, readily stretched by the blood which it compresses, and easily torn, becomes a frequent and an intelligible cause of dire distress, and of death. Concerning this most perilous cardiac disease our knowledge is of modern acquisition. In the larger arteries also, where it has long been known under the name of *atheroma*, the same form of decay leads to dilatations, to aneurisms, to fatal ruptures. When it occupies the smaller branches of the same vessel it tends to softening of the parts which those branches then fail to nourish and maintain, and to the escape of blood from their broken channels into and among the softened textures. This is a very common source of cerebral mischief—of apoplexies, and of palsies.

Following out Mr. Hunter's original views, Mr. Paget has satisfied himself that the singular disease of bones described by English writers under the name of *mollities ossium*, is also owing to this fatty degeneration. Nay, the same morbid change may pervade the whole body. In all ranks of life there are two well-marked forms of senile decay: and everyone will at once, I think, recognise the fidelity of the following graphic sketch by Mr. Paget's pencil.

'Some people, as they grow old, seem only to wither and dry up—sharp-featured, shrivelled, spinous old folks, yet withal wiry and tough, clinging to life, and letting death have them, as it were, by small instalments slowly paid. Such are the "lean and slippered pantaloons," and their "shrunk shanks" declare the pervading atrophy.

'Others—women more often than men—as old and as ill-nourished as these—make a far different appearance. With these the first sign of old age is that they grow fat; and this abides with them till, it may be, in a last illness sharper than old age, they are robbed even of their fat. These too, when old age sets in, become pursy, short-winded, pot-bellied, pale and flabby; their skin hangs, not in wrinkles, but in rolls; and their voice, instead of rising "towards childish treble," becomes gruff and husky.

'Now, these classes of old people may represent the two forms of atrophy—of that atrophy by decrease, and that by degeneration of tissue—to which we shall find nearly every part of the body liable. In those of the first class you find all the tissues healthy, hardly altered from the time of vigour. I examined the muscles of such a one lately—a woman, seventy-six years old, very lean, emaciated, and shrivelled. The fibres were rather soft, yet nearly as ruddy and as strongly marked as those of a vigorous man; her skin too was tough and dry; her bones, slender indeed, yet hard and clean: her defect was a simple defect of quantity.

'But in those that grow fat as they grow old, you find, in all the tissues alike, bulk with imperfect texture; fat laid between, and even within, the muscular fibres, fat about the heart, the kidneys, and all the vessels; and the bones so greasy that no art can clean them: the defect of all these is the defect of quality.'

All these fatty changes are plainly morbid. The transformations that are effected in false joints are as evidently methods of accommodation and repair. The same may be said of the transformation—which is not conversion—of areolar tissue into synovial membrane. Synovial membrane consists chiefly of condensed areolar tissue. Sir Benjamin Brodie, in his book on Diseases of the Joints, gives instances of synovial membranes being formed, where none before existed. 'In a young lady who had attained the age of ten or twelve years, labouring under the inconvenience of a club-foot, a large bursa was distinctly to be felt on that part of the instep which came in contact with the ground in walking. In another young lady, who had apparently recovered of a caries of the spine, attended with a considerable angular curvature, a bursa appeared to have been formed between the projecting spinous process and the skin.'

In like manner we find that sinuses, fistulous openings and tubes, in various parts, become lined, through the intervention of the connective tissue, with a surface which in its appearance and in its properties resembles the mucous membranes. Like them it is with difficulty made to take on adhesive inflammation; and therefore it is that sinuses of this kind, and chronic abscesses, are often so troublesome to the surgeon, and require to be laid open before they can be abolished.

On the other hand, the mucous membranes, under peculiar circumstances, approximate to the skin in their physical aspect and qualities. When, for instance, a portion of the mucous lining of the rectum, or of the vagina, protrudes externally, is permanently exposed to the air, and subject to the friction of clothes or of neighbouring parts—that is to say, when it is placed under the same conditions as the skin—it assumes somewhat the characters of the skin: it gradually loses its red colour and approaches the tint of the skin, ceases to pour forth mucus, becomes dry, obtains even a sort of cuticle, acquires firmness and density, and is less sensible to the contact and pressure of foreign substances. It is impossible not to perceive the beneficial nature of this transformation.

The greater number, then, of those interesting changes in the living body which have been classed under the head of transformations of tissue, have a restorative tendency. They exemplify the working of what the older pathologists discerned, and called the *vis medicatrix naturæ.* This is a phrase that has been much sneered at; but (as I conceive) very unjustly, and sometimes ignorantly. It is simply a short formulary, expressive of a great general truth, viz., that the animal frame is so constituted as to contain within itself the elements of repair, and of conservative adaptation. To a great extent it is a *self-mending* machine. Surely this is an admirable provision, and clearly indicative both of wise contrivance and of beneficent design.

The intimate texture of parts may be further altered—not simply by some modification or reconstruction of the ordinary tissues, but—by an absolute disappearance or confusion of all regular structure. This is usually a consequence, either of the effusion, in the natural interstices of the parts, of fluids, which afterwards pass into the solid state, or it is a consequence of the growth of solids which do not belong to the healthy body. In this sketch of general pathology I must content myself with thus briefly alluding to this source of morbid change.

Lastly, let us take a glance at the changes of *situation* to which the solid parts of the body are liable. They are sometimes of very serious import.

These changes of place—sometimes the consequence of disease, sometimes its cause, and not unfrequently the cause of death—respect chiefly the viscera; and most especially the viscera of the chest, abdomen, and pelvis. I omit dislocations of joints, as belonging exclusively to surgery.

In the chest, a whole lung may be displaced, and compressed against the vertebral column, by blood, or serum, or air, effused into the cavity of the pleura. An alteration of this kind, whereby one-half of the respiratory apparatus is rendered incapable of its peculiar function, cannot be otherwise than full of peril.

The very same causes operating on the left side of the thorax may dislocate the heart, thrust it over to the right of the sternum, where it may be felt, and heard, and seen, to pulsate. This again cannot happen without greatly disturbing the vital function of circulation, and putting life in jeopardy.

Yet neither of these serious displacements is necessarily fatal. Both admit, under certain circumstances, of remedial treatment; as I hope to prove to you hereafter.

In the abdomen and pelvis, the various forms of hernia may be adduced as involving very dangerous changes in the place and relative position of parts. Portions of the intestinal tube are apt to pass through accidental openings in the diaphragm—or between the edges of the linea alba surrounding the navel—or out at the abdominal ring—or through some other natural or accidental aperture. I need not tell you how fearfully life is compromised when, in consequence of such faulty position, the bowel becomes constricted—when its contents can no longer pass onwards, and inflammation, or gangrene, is present or impending. Even when there is no strangulation, the mere displacement, arising from the escape of some of the contents of the abdomen and pelvis from their natural limits, may be productive of much discomfort, deformity, and hazard. Of this the historian Gibbon presented a remarkable example. He had an immense scrotal hernia; so large it was, that it hung down very nearly as low as his knees. After his death it was found that almost the whole of the omentum, and the greater part of the colon, had descended into the scrotum, and had dragged the stomach after them; so that its pyloric orifice lay close to the abdominal ring.

Akin to hernia is that partial displacement of the bowel in which a portion of it passes, not through any natural or accidental opening, but into the bowel itself: just as one portion of the finger of a glove is sometimes pulled into the other and upper part, by the withdrawal of one's hand. The contain*ed* portion of intestine is liable to be nipped and strangled by the contain*ing* portion—and all the peril of hernia results, with much less chance of relief by art. This state of things is called *intus-susception.*

Exactly of the same nature, though less alarming, is *prolapsus* of the rectum, or of the vagina. Here also a portion of the tube passes into the contiguous portion; but being near the extremity of the canal, the inverted part protrudes externally, and becomes, in most cases, a source of distress and suffering, rather than of danger. Inversion of the uterus is another example.

Again, one, very rarely both, of the kidneys may, through some laxness in their tethering, wander away from their natural anchorage, now deep down into the pelvis, now up beneath the ribs; constituting moveable, or, as they sometimes are called, floating tumours, which try the diagnostic power of the enquiring physician.

Thus much, then, of the changes to which the *solid* parts of the body are subject, in *size*, in *form*, in *consistence*, in *texture*, in *situation*.

You cannot fail to perceive the injurious effects which many of these changes in the various solids are calculated to produce upon the movements and working of the living machine; how some of them must impede or derange its natural action; some stop that action altogether.

Now the fluid parts of the body are liable also to alterations, which, if they be not always so obvious as those of the solids, are certainly not of less moment.

You are probably aware that, for many centuries, the fluids were supposed to be the primary agents in every form of disease; that all maladies were attributed to some acrimony or peccant state of the humours; and that however else the theories of medicine might vary and fluctuate, the *humoral* pathology, till a comparatively recent period, ran through almost all of them. At length, the absurdity of the hypotheses, and still more the dangerous practice, which this doctrine generated, began to be manifest, and led to its total abandonment. Rather more than a century and a half ago, the foundation of the opposite doctrine appears to have been laid, by the writings of Glisson in this country, and by those of Baglivi in Italy; and presently the notion came to prevail throughout the schools, that all the morbid conditions of the body had their exclusive origin in the solids. The pendulum of opinion swung at once, as is usual, into the opposite extreme of error. It is settling, in our time, at the juster medium. Reviving under new and more faithful evidence, the humoral doctrine again asserts its rightful but modified claims upon our acceptance. That its old extravagancies still find favour among the ignorant, and are commonly adopted by the quack, are circumstances which illustrate the fact that the mischievous influence of unsound theories survives the duration of the theories themselves. The scientific physician of the present day can only wonder how exclusive solidism, or exclusive humoralism, should ever have found advocates.

LECTURE IV.

Morbid Alterations of the Fluids, especially of the Blood. Changes in its quantity and distribution. General and Local Plethora. Poverty of Blood. Active Congestion—its Phenomena—State of the Vessels as seen by the Microscope. Mechanical Congestion. Passive Congestion. Relations of these forms of Congestion to Inflammations—to Hæmorrhages—to Dropsies.

After running over the principal alterations to which the solid parts of the body are liable, we were beginning to enquire into those no less important morbid changes which are apt to take place in its fluid constituents. I reminded you that, respecting the whole of this subject, pathologists had passed from one extreme of opinion to another; that for a very long period the *humoral pathology* prevailed in the schools, and that, in times not very remote from our own, it was entirely superseded by the opposite doctrine of exclusive *solidism*. It is strange that either misconception should have so long maintained its ground.

If we consider the definite relation subsisting between the solids and the fluids of the body, and the unceasing agencies which they mutually exercise on each other—how, for instance, on the one hand, all the solids are originally built up, and are afterwards perpetually sustained and repaired by materials furnished from the blood — how, again, on the other hand, some of the solids are continually employed in the reciprocal office of feeding and renewing the blood, while others are as constantly at work in decompounding it by the various secretions — we cannot avoid perceiving that distinctions of the kind I have mentioned, founded upon mere differences of consistence, are futile. Flesh and blood are almost convertible terms: their composition, the chemists tell us, is identically the same. To use the strong expression of Bordeu, *Le sang est de la chair coulante.* You may be certain that no notable alteration can take place in the solids of the body which will not soon affect in some way its fluids; and that every important change in its fluids must lead to, or proceed from, a corresponding and proportionate modification of its solids. The long dispute between the solidists and the humoralists was altogether baseless and unprofitable.

Mr. Paget, in the admirable lectures to which I have already referred, cites and adopts the proposition of Treviranus, that 'each single part of the body, in respect of its nutrition, stands to the whole body in the relation of an excreted substance.' 'In other words, every part of the body, by taking from the blood the peculiar substances which it needs for its own nutrition, does thereby act as an excretory organ, inasmuch as it removes from the blood that which, if retained in it, would be injurious to the nutrition of the rest of the body. For example, the polypiferous zoophytes all excrete large quantities of calcareous and siliceous earths. In those which have no stony skeletons these earths are absolutely and utterly excreted; but in those in which they form the skeleton, they are, though retained within the body, yet as truly excreted from the blood and all the other parts, as if they had been thrown out and washed away. So the phosphates which are deposited in our bones are as effectually excreted from the blood and the other tissues, as those which are discharged with the urine.'

This doctrine, if it be true, as I think it is, puts in a strong light, not only the constant relation and interchange subsisting between the solid tissues of the body and its fluids in health, but their inevitable sympathies also in disease.

The animal fluids are—the blood, the fluids that enter the blood, and the fluids that proceed from the blood.

The fluids that enter the blood are of two kinds.

1. Those by which it is renewed and enriched.
2. Those which enter it in order that they may be conveyed out of the body.

Now, although we cannot doubt that any considerable modification or defect of the fluids that feed and renovate the blood, and particularly of the chyle, must have a direct influence upon its composition and quality, we really know but little about them, except in their effects. We seldom have any means of procuring these the first products of nutrition so as to examine them, or to test their qualities; yet we can perceive causes that are likely to deteriorate or deprave those fluids (unfit aliment, impure air), and we know that, under the continued operation of such causes, the blood, replenished by these fluids, *is* actually and sensibly modified.

Again, we cannot doubt that some of the matters derived from the body itself, and taken into the blood in order to be conveyed away, may, and often do, directly alter and contaminate the blood, and act as poisons upon the system: matters, for instance, absorbed from parts of the body that are diseased, or dead and putrefying; in this way, doubtless, disorders which were at first strictly local may come to affect the whole economy: matters, again, which, though harmless while merely transitory, and in minute quantity, prove noxious when retained and accumulated in the blood, in consequence of faulty or deficient action of the organs destined to eliminate them from the circulating fluid. The injurious effects of some of the substances which thus become deleterious,—as urea, of which the blood, during health, is continually purified by the kidneys; and bile, which is naturally separated therefrom by the liver; and carbonic acid, which it is the office of the lungs to excrete —will furnish topics of interesting enquiry hereafter.

The fluids that *leave* the blood may be considered under a threefold division.

1. Those which are directly expended in the growth or maintenance of parts, some of them becoming fixed and solid, and others retaining their fluid condition.

2. Those that are employed in aid of some definite function of the body: as the saliva, the gastric juice, the bile, the pancreatic secretion, the tears, the synovia of the joints, and so on. Now, these may be secreted in excessive abundance, or in too scanty quantity, or of imperfect quality, or not at all: and all, or any, of these deviations from the healthy standard may be the result of very serious disease, or may cause very serious disease; and they will be spoken of hereafter when the disorders of the parts or functions connected with each shall be discussed.

3. Those which are separated from the blood merely to be excreted, as the urine, certain discharges from the bowels, and from the bronchi and skin. Some of these are extremely worthy of study, as furnishing, in their altered qualities, indications of disease; but they require no particular consideration in this part of the course.

Dismissing therefore, for the present, all further account, as well of the fluids that concur to form the blood, as of the fluids that issue from the blood, let us enquire what morbid changes the blood itself is liable to undergo.

The blood, then, is subject, first, to remarkable variations in its *quantity*, both with respect to the whole system, and with respect to particular organs and tissues.

2. Closely connected with these differences of quantity is the variation which is observable in regard to the proportions between the several proximate constituents of the blood. The changes that occur of this kind are sometimes strikingly evident to our senses. For example, we not unfrequently perceive that the blood drawn from a vein is thinner, manifestly more watery, less rich in red corpuscles and in colouring matter, than blood of the standard quality.

3. Again, independently of mere alterations in the relative proportions of its proximate constituent parts, the blood is liable to great change in its chemical composition, and, therefore, in its physical quality. This appears to be the case in sea-scurvy, and in the analogous disease called purpura, and it is doubtless so in many other complaints.

The composition of the blood cannot fail to be affected by a deficient supply of the elements of nutrition from without; by diseases of the digestive organs, interfering with the process of chylification; by diseases of the organs of respiration, interfering with its change from venous to arterial; by diseases of other channels of excretion—the bowels, the biliary apparatus, the kidneys, the skin—interfering (as I have already hinted) with its appointed purification; nay, by disease in any part, if Treviranus' theory be allowed; by foreign contaminating matters, finding entrance (as they may when in solution, or in a gaseous form) through artery, vein, or any membranous substance, such as bladder and intestine: lastly, the composition of the blood may be altered, there is good reason to believe, by certain states of the nervous system.

It is truly observed by Dr. William Addison, that the very 'aspect and sensible qualities of the blood prove that its condition varies remarkably under different circumstances, the coagulum being either buffed, firm, soft, or tar-like. It is of various colours and odours, and it putrefies sooner in one case than it does in another.'

But contenting myself with having indicated these latter changes, or sources of change, I shall defer giving a more particular account of any except those that relate to the *quantity* and the *distribution* of the blood.

Bear in mind that the blood as it exists in the living body, consists of a liquid (the liquor sanguinis) in which the fibrin of the blood is dissolved, and in which float many coloured corpuscles or globules, and a few that are pale. Of these last we need take at present no further account.

The coloured corpuscles are not soft solids, but closed cells, or little bags, containing a red-coloured fluid, while their investing membrane is white or colourless. Neither are they, in their standard degree of distension, perfect spheres, but circular discs with slightly depressed centres.

Through the investing membrane, in obedience to the law of endosmosis, the fluids without and within the corpuscle reciprocally pass. Placed in a liquid of greater specific gravity than the average specific gravity of the liquor sanguinis, the corpuscles shrivel, and the liquid is much reddened. On the other hand, if the surrounding liquid have a specific gravity less than that of the liquor sanguinis, it is but slightly reddened, and the corpuscles plump up. In pure water they burst.

To return to the topic from which I have somewhat digressed. The blood, I say, may undergo important alterations in its *quantity*. It may exist in unnatural abundance throughout the body; and it may exist in unnatural abundance in certain parts only of the body. These states have been recognised for ages. Sometimes they are called respectively general and partial *plethora*; sometimes general and local *congestions* of blood; people speak also of irregular *determinations* of blood to different organs; and, of late years, the term *hyperæmia*, first invented by M. Andral in France, has been imported into this country, and much adopted here. All these words and phrases mean, in truth, the same thing; and their frequent recurrence in medical works, is, of itself, sufficient evidence of the frequency and importance of the conditions which they express.

If we comprehend rightly this subject of plethora or congestion, we shall be prepared to understand some most important morbid states, of which it seems to be in many cases a very early, if not the initial step. Inflammation, hæmorrhage, dropsy, all acknowledge and imply a previous condition of congestion. 'There is probably,' says Dr. Alison, 'no kind of diseased action of which any part of the living body is susceptible, which is not connected, sooner or later, with increased afflux of blood towards that part, either as its cause or its effect; and the immediate object of all our most powerful remedies is to act on these irregularities of the circulation.'

Prior to all enquiry as to the how or the why, we know that the blood *may* be differently distributed in the capillaries at different times, by observing the variable colour of the surface, which depends upon the varying degrees of fulness of the cutaneous blood-vessels. The blush of modesty, the red cheek of anger, the heightened colour of the skin under brisk exercise, are familiar facts illustrative of partial plethora of the capillaries, consistent with health.

There are good reasons (which I shall hereafter lay before you) for believing that a similar sudden accumulation of blood, taking place in internal parts, may sensibly disturb their functions; causing, for example, transient fits of giddiness, insensibility, and sometimes death itself, when the congestion affects the *cerebral* blood-vessels; or attacks of difficult breathing when the capillaries of the *pulmonary* tissue are concerned; and even *these* attacks, for aught that I know, may end fatally.

It often happens that when certain portions of the surface, as the cheeks, are visibly redder and fuller of blood than usual, or when such symptoms as I have just mentioned denote the probability of some internal congestion, other parts of the surface, as in the extremities, are visibly paler: and there are, at the same time, corresponding and palpable differences of temperature. And the comparative unnatural emptiness of the capillaries thus manifested may (and doubtless does) occur internally also, and play an important part in some forms of disease.

Perhaps it may not be so obvious that the whole quantity of blood, throughout the body, is sometimes in excess.

That in the adult state, when the growth and development of the body have been completed, blood may be made in greater abundance, and more rich in the materials of nutrition than the wants of the body require, is not only conceivable, but a fact. We are able to assign circumstances in which this is likely to happen, and we find that under such circumstances it actually does happen. Full living, and a sedentary life, are causes likely to occasion general plethora—and they do occasion it. The full diet, so long as the digestive powers are perfect, provides more chyle, conducts into the blood a larger quantity of its proper pabulum. The sedentary life precludes that freer circulation of the blood, and that more liberal expenditure of it through the skin, and by means of the other organs of secretion and excretion, which would occur under more active habits. Persons thus circumstanced are apt to grow fat; the adipous tissue seeming, in these cases, to form a kind of safety valve for the diversion of the superfluous blood. Such persons have turgid and florid cheeks, red lips, red mucous membranes, and (not uncommonly) ferrety eyes. Their entire vascular system is preternaturally distended. If you open a vein, you find that they bear a copious abstraction of blood without fainting, and are even refreshed by it; and the blood drawn separates into a large and firm mass of coagulum with but little serum. Keeping to the nomenclature we have already employed, we might say that there is here *hypertrophy* of the blood.

When inflammation arises in the subjects of this general plethora, it is said to run high, and to require active treatment. But they are not, as you might naturally expect them to be, and as many writers state them to be, peculiarly prone to suffer inflammatory complaints. There is general fulness of the vascular system, but no irregularity, nor any necessary tendency to irregularity, in the distribution of the blood.

You will observe that the relative proportion of the more solid to the more fluid constituents of the blood is increased in these cases of general plethora: the blood is not only more abundant, but it is richer also in red particles.

The means to be adopted for redressing this unnatural and unsafe condition of the circulation, are those which common sense would suggest. The removal of a portion of the superfluous blood, a more restricted diet, a larger allowance of active exercise.

It will be worth our while to contrast this state of general plethora with its opposite—that in which the blood is scanty and poor—what Andral calls (though with questionable propriety) *anæmia*. *Oligæmia* is the cacophonous but more exact name assigned to it by Gendrin; but *poverty of blood* is the ordinary English phrase for it, and the best of the three. This is a state which we can produce at will, by abstracting blood from the body in moderate quantity, but repeatedly, and at short intervals. It occurs also, frequently, in spontaneous disease, and from various causes; from a privation of the materials destined to replenish the blood; and in cases in which these materials appear to be turned to little account, as in chlorotic girls. We see it in those who habitually and often lose a certain quantity of blood, in disease; in persons, for example, who are subject to piles, and who bleed daily from the rectum; still oftener in women who suffer repeated hæmorrhages from the uterus. When the drain has been long-continued, these persons become very pale; even those parts which are naturally most red, as the lips and tongue, become almost white; their faces look like wax; and if you draw blood from a vein, and allow it to coagulate, you will have a small clot floating in an abundance of serum, and that small clot will be of a light rosy colour; showing a great diminution in the proportion of fibrin; and a still greater deficiency of the red particles. The blood, as they say, is 'turned into water.' It is a curious pathological fact, that the red particles require more time for their restoration than the other constituents of the blood. And I may mention to you now, what I shall have to repeat, that—in conjunction with the obvious curative measures comprised in arresting the habitual loss of the vital fluid, and in affording sufficient nutriment to the system—the preparations of iron, and the respiration of pure air, have signal efficacy, in renewing the red particles, and giving back again their native hue of redness to the cheeks and lips.

In connection with this subject, I would direct your attention to some interesting statements of Dr. Owen Rees' in his Gulstonian Lectures, delivered before the College of Physicians in 1845, and subsequently published in the 'Medical Gazette.'

The iron of the blood resides in the colouring matter dissolved in the liquid which is enclosed in the colourless envelope of the corpuscles.

The blood is fed by the chyle. The chyle, like the blood, separates, when removed from the body, into two parts—serum, and crassamentum.

The serum of the blood contains no iron; the serum of the chyle contains iron in abundance. The crassamentum of the blood contains iron; that of the chyle only such a trace of it as may be accounted for by the adhering serum.

Again—the specific gravity of the chyle is far below that of the liquor sanguinis. Hence, on the mingling of these fluids, an endosmotic transmission of iron in solution will take place into the corpuscles.

It follows, that if the specific gravity of the liquor sanguinis be any-how lowered, or that of the chyle much increased, the supply of iron to the corpuscles will be so far impaired.

These considerations may hereafter be found applicable to the elucidation both of the nature, and of the treatment of certain forms of disease.

In general plethora every part is preternaturally full of blood, and the blood itself is full of the elements of nutrition. General plethora therefore implies, *in one sense*, local plethora of every organ and tissue. In strictness, however, local plethora is only predicable of a part that contains more than its share of red blood.

Now the converse of this is not true, as it might be expected to be, of the opposite state. A defective condition of the whole mass of red blood contained in, and circulating through, the body, does not protect the *parts* of the body from congestion—from having an undue quantity of blood sent to them. Far from it. Local determinations of blood are *very common* in persons in whom the mass of that fluid, or the proportion of its nutritive materials, has been considerably diminished by disease, or by hæmorrhage.

This remarkable tendency, under such circumstances, to an unequal distribution of the blood in the capillaries, admits (I think) of the following explanation. A due supply of healthy blood is requisite for the steady and equable performance of the functions of the nervous system. When this supply is defective, or uncertain, those functions become disordered and irregular, and, in their turn, disturb and derange the balance of the circulation. That capillary blood-vessels may be filled to excess, or completely emptied, by causes operating *through the nervous system*—by moral emotions, for example,—we are sure from the phenomena just now adverted to, the blush of shame or anger, the paleness of fear; and there can be no doubt that *morbid* congestions, which sometimes are separated from those that are consistent with health by very slight shades of difference, are often determined through the agency of the same nervous system. And persons endowed with great sensibility or irritability of the nervous system are very liable to partial and irregular congestions of blood.

But this is not the only way in which local congestion may arise.

We can produce it, upon the surface of the body at least, at pleasure, and that in various ways; by friction, by exposing the part to a high temperature, by certain stimulating applications, mechanical (as a cupping glass), or chemical (as a mustard poultice): we produce an injection of the small cutaneous blood-vessels; there is, evidently, more than the usual quantity of blood attracted to the part, or detained in the part—a degree of redness, which soon subsides if the cause of it be withdrawn in time.

Congestion thus occasioned is not inflammation, but it is the first obvious step towards that complex process; and for this reason it deserves all your attention. Apply the exciting cause a little longer, or increase, in a slight degree, its intensity, and the phenomena of inflammation begin to manifest themselves.

I said we can excite local congestion, when we please, upon the *surface* of the body: but there can be no doubt that a similar state may be produced by analogous causes, in internal parts. Look at this representation of the stomach of a dog (*one of Dr. Roupell's plates*). You see one portion of it of a bright red colour, actively and vividly congested. This was the consequence of a dose of alcohol. We may be certain that something of the same kind is the result, in the human stomach, of every visit to the gin shop.

Local congestion thus produced, or of this kind, is said to be *active*. M. Andral, whose nomenclature has come much into fashion of late years, calls it sthenic, or active hyperæmia. The arteries, perhaps, have more to do with it, in the first instance, than the veins. But it is in and through the capillary vessels, interposed between the minute arteries and veins, that further changes are wrought, when the process advances a stage beyond mere local plethora.

You will have a clearer notion of the actual phenomena of the circulation of the blood through the smaller blood-vessels, if I can bring before your minds the scene which presents itself when the transparent web of a frog's foot is looked at through a good microscope. It is a most beautiful and wonderful spectacle, and particularly interesting to those who, like ourselves, are desirous of gaining some insight into both the healthy and the diseased states of the circulation. It is a sight which you will have many opportunities of seeing in this place. You perceive, then, occupying the circular field of the instrument, a number of blood-vessels, through which the blood, with its corpuscles or globules, is in active motion; and you see at once that there are three different kinds of vessels before you. First, you notice the blood shooting swiftly along tubes which divide and subdivide into smaller and smaller branches, each branch (speaking generally) going off at an obtuse angle: these are plainly arteries. Then, in another part of the field of view, you see the blood moving in the contrary direction, more slowly, in larger trunks, which are formed by the continual accession and union of smaller and tributary vessels of the same kind, that meet, for the most part, at acute angles; these you know to be veins: and all the intermediate and surrounding surface in view is occupied with other vessels or channels, which connect themselves with the ultimate ramifications of the arteries on the one hand, and with the primary radicles of the veins on the other, but which differ from both arteries and veins in these particulars—that they interlace and anastomose in all parts, in a very irregular manner, and at all angles, and that they retain everywhere the same uniform size. They neither collect into larger and larger trunks, nor separate into smaller and smaller branches, but are disposed like the threads forming the meshes of a net, except that the interstices are irregular in size and shape. These are the true capillaries, intermediate between the arteries and the veins, and perfectly distinct in character from each, but communicating and contiguous with both.

Minute anatomy discloses other notable differences. The walls of the capillaries are simple, delicate, very thin, and therefore readily pervious by fluids, and easily broken: those of the minute arteries are thicker, stronger, complex, embraced by muscular fibres, and supplied with small (*vaso-motor*) nerves. These nerves determine the degree of contraction of the muscular fibres, and so control and regulate the calibre of the vessels as to vary, at different times and in different parts of the body, the quantity of the blood dispensed to the capillaries of those parts. Professor Huxley illustrates the differences of function between these differing tubes by a happy metaphor which represents the capillaries as irrigating the surrounding tissues, and the minute arteries as governing the amount of the irrigation. 'The contraction (he says) or dilatation of the arteries supplying a set of capillaries comes to the same result as lowering or raising the sluice-gates of a system of irrigation canals.' The practical importance of this local control exerted by the nerves is justly spoken of by the same able writer as being 'immense.'

In watching closely the movement of the blood through the capillaries, you will further remark that the red corpuscles are not uniformly distributed throughout the liquor sanguinis in which they float, but keep chiefly the mid-channel, so that there is a central stream full of corpuscles, separated from the walls of the capillary vessel by liquor sanguinis in which there are few or no corpuscles.

Now, if the web be irritated by pricking it, the following appearances soon occur:—at first the vessels become fuller, and the velocity of the blood appears to be accelerated. But presently the red corpuscles cease to occupy so completely the centre of the stream in which they float; they retain (says Kaltenbrunner, an accurate and faithful observer) the character of the arterial globules even when they reach the veins, presenting a bright colour, showing a tendency to stick together, and often forming little clots, which pass through the capillaries and become visible in the veins.

One of the natural functions of the web is the secretion of a kind of lymph; but this secretion is now suspended. The parenchyma itself begins to be slightly tumid, and assumes a brighter tint than common.

All these phenomena begin from a circumscribed spot, of which the circumference gradually expands as the affection increases; and they cease insensibly at that circumference.

This is active congestion.

Active congestion, as such, does not continue long. It either passes on into inflammation, as I shall hereafter explain, or it begins to decrease. When it has been very slight, the quantity of blood, and the rapidity of its movement, diminish gradually from the circumference towards the centre; and in this way the congestion insensibly vanishes.

But, in other cases, when it has not been so slight, the congestion terminates by an evident crisis, which Kaltenbrunner thus describes:—The blood, receding from the circumference of the congested part towards the centre, gives out, by exhalation, a liquid. The exhalation takes place by fits, and here and there, through the sides of the capillary tubes, and generally on the surface of the organ. The moment of exhalation is very transient; but it is repeated often, and in different spots, until the congestion has disappeared. It is evidently critical, for the congestion is relieved and extinguished in proportion as the exhalation is repeated.

I shall follow these consequences of active and continued local congestion no further at present; but merely remind you again that the changes I have last mentioned constitute the earliest appreciable modification of structure, leading or belonging to inflammation. What we thus may see (and it is what I myself have had many opportunities of seeing) in the transparent textures of animals, we reasonably infer to take place, under analogous circumstances, in those parts of the body which are internal and opaque, and consequently hidden from our view.

I will just observe, also, that as active congestion is the parent of inflammation, so it sometimes causes hæmorrhage, and is relieved by it. But, comparing this form of congestion with another which I am about to mention, the connection of hæmorrhage with it is, relatively, unfrequent.

One obvious mode of remedying this congestion is the mechanical abstraction of blood from the loaded part. But it is seldom that this measure alone suffices; and sometimes it would be ultimately hurtful to adopt it. The state of the constitution may be such, that the disposition to local plethora would be increased by the loss of blood. Undue susceptibility and disordered action of the nervous system are liable to be aggravated by bleeding; and in proportion as the nervous functions are irregularly performed, does the tendency to unequal distribution of blood in the capillary vessels augment. We have daily examples of this in hysterical young women. It is not, therefore, the mere congestion that we have to consider; we must look deeper, for its cause. Leave in the finger a small thorn: the blood will be collected there in consequence of the abiding irritation, and will continue to collect in spite of depletion. But extract the thorn, and your remedial measure of taking away blood is at once successful. So it is also with internal congestions of blood—of which the exciting and sustaining cause is not always so well known.

Contrasted, in some important particulars, with active congestion such as I have been describing, is that morbid fulness of the capillary vessels which arises when the return of the blood from them towards the heart through the veins, is impeded by some *mechanical* obstacle. With this *mechanical congestion* the veins are exclusively concerned.

Congestion of this kind may be strictly local. It may be confined to a single limb, when the principal venous trunk belonging to that limb is compressed, or otherwise diminished in size; and when no collateral and compensatory channels for the returning blood have been established. If there be disease of the liver, of such a nature as to prevent a free passage of the blood through that organ, congestion will ensue in all those parts of the capillary system from which the blood is conveyed by the veins that ultimately concur to form the vena portæ. The force of gravity alone is sufficient to produce venous congestion, and consequently congestion of the capillaries, in parts of the body in which, under ordinary circumstances, the circulation through the veins is aided, instead of being opposed, by that force. If, for instance, the head be suffered to hang downwards for a certain time, we see the unequivocal signs of such congestion in the tumid condition and the purplish red colour of the lips, cheeks, eyelids, and ears. When an impediment to the free transmission of blood exists in the heart itself, a tendency to stagnation is produced, first in the venæ cavæ, then in the smaller ramifications by which these veins are fed, and at length in the general system of capillary vessels: and thus even general congestion may proceed from a fixed mechanical cause; the parts that are the most vascular being also the most readily and the most completely gorged.

There is yet a third form of local congestion, differing, in some respects, both from active and from mechanical congestion. The capillaries become loaded, and the course of the blood in them is languid and sluggish, without any previous increased velocity of the blood in the arteries, and independently of any mechanical obstacle in the veins. To this form of congestion the term *passive* is applied. Andral denominates it passive or asthenic hyperæmia. I will tell you the class of facts from the observation of which the real existence of this passive plethora has been ascertained.

In persons enfeebled by age, or by disease, the lower parts of the legs, the insteps and ankles, and the skin which forms the surface of old scars, are often habitually purplish, or violet coloured. There is congestion of dark blood in those parts. You may, perhaps, be ready to ascribe this to the mere influence of gravity upon the blood, but this cannot be the whole explanation, because the force of gravity is the same with all persons, and at all ages. A horizontal position of the limb will perhaps diminish the livid redness, or may even sometimes entirely remove it. But the depending position ought not to cause it, and would not cause it, if the blood-vessels were in a healthy condition. Neither can the difference of posture be any source of *irritation* to the congested part. The capillaries themselves appear to have lost, in a great degree, their natural elasticity; they easily dilate under the pressure of the blood, which, being thus retarded, accumulates in the part. The employment of friction, or some stimulating application, will often remove this congestion.

I say all this is often to be noticed when there has been no cause of irritation operating upon the part, and no preceding state of active congestion. But it is important to mark the very frequent connection that exists between these contrasted conditions. The one very often succeeds the other: the vessels become dilated under the force of the active hyperæmia, and, the irritation ceasing, they do not at once recover their tone, but remain passively loaded and distended. They are frequently left in the same state upon the subsidence of inflammation.

Take another illustration from what you may any day witness in certain indolent ulcers. You will find that the large, flabby, and livid granulations which they present, may be made to contract and to assume a more healthy and florid hue, by local stimulants: these evidently act by quickening the previously languid circulation, and unloading the congested capillaries.

Observe, again, what not unfrequently happens in regard to the eye; a little organ indeed, but one that supplies us with more striking lessons in pathology and therapeutics than any other portion of the body. You know that the conjunctiva and sclerotica, through which, while healthy, colourless fluids alone circulate, are traversed, under various forms of disease, by innumerable vessels bearing red blood. Now, it is notorious that, in certain cases, the application of any stimulating substance to the surface of the organ will increase the existing redness, multiply the number of visible vessels, and aggravate the complaint. These are cases of active congestion, dependent upon irritation that is still subsisting. But it is equally well known to practical men that the blood-vessels of the eye are liable to congestion of a very different kind. They are seen to be distended, somewhat tortuous, almost varicose, and the redness has a browner tinge, and is less vivid, than in the former case. In this kind of vascular fulness,—or in this *stage* of it, for it sometimes succeeds to active congestion,—emollient applications do harm rather than good, while strongly astringent and even irritant substances will often promptly dissipate the vascularity. These, again, are cases illustrative of congestion of the asthenic or passive character. The strong topical irritants restore to the feeble and relaxed vessels their natural elasticity, stimulate them to contract upon their contents, and to force onwards the red blood, which they cease to admit from the arteries; and the redness vanishes.

In the production of *active* congestion the arteries appear to be principally concerned: in the production of *mechanical* congestion, the veins. In *passive* congestion the capillaries—which, strictly, are neither arteries nor veins, but lie between the arteries and the veins—are the vessels chiefly in fault.

If we turn our thoughts from the visible textures of the body to those which are hidden internally, we shall find reason to believe that these also are equally liable to similar conditions of passive congestion. Take those exceedingly vascular organs, the lungs, through which the whole of the blood circulating in the living body has to pass. The lungs, as might be expected, are *very* liable to congestion and engorgement of their capillary vessels. Ofttimes this is clearly active, and the result of some irritating cause. But it is not always so. Some of you recollect the epidemic disorder called the influenza, which was so prevalent here in the spring of 1831, and again in the early part of 1837. Among the most constant and striking characters of the disease were the symptoms of pulmonary catarrh; and it was remarkable how long, in some persons, these symptoms persisted. After the pulse had regained its natural frequency of beat, and when all fever had ceased, the patient would continue to breathe with constraint and some labour, to wheeze a little, to cough, and to expectorate mucus. As all febrile disturbance had subsided, and no further benefit seemed to flow from adhering to what has been called the antiphlogistic system, it was a reasonable conjecture that this disappointing obstinacy of some of the symptoms might depend upon a lingering but passive congestion of the pulmonary mucous membrane. And the nature of the *juvantia* showed the correctness of this conjecture. Tonics and stimulants, so far from aggravating the pectoral symptoms, speedily removed or abated them.

You cannot fail, I think, to perceive the important bearing of these distinctions between active andpassive congestion upon our notions of disease and our choice of remedies. These distinctions are not to be discovered by the knife of the anatomist. You must take care not to confound a knowledge of pathology, in the proper sense of that word, with a knowledge of morbid anatomy. Pathology comprehends not only the visible changes of structure which accompany disease, and are disclosed by death, but the processes by which those changes are effected in the living body, and the laws which govern those processes.

There is one important law ascertained in repect to both active and passive congestion; viz., that it is apt to *recur*; that those parts are most likely to suffer it (or inflammation, which implies it) that have suffered it before. We may often turn our knowledge of this general fact to good account, in what is termed the *prophylaxis* of disease—in devising means for warding off disorders.

I have stated that *active* and *passive* congestion sometimes occur in succession, the latter being a sequel of the former. So, also, it may be said of *passive* and of *mechanical* congestion, that they often exist *together*. If the capillaries of a part or organ be much enfeebled, the mechanical effect of the gravity of the blood may suffice to bring them into a state of congestion.

It is thus that Andral explains the occurrence of a gorged condition of the posterior portions of the lungs (evinced by symptoms during life, as well as by inspection of those parts after death), in persons who, having laboured under no previous pulmonary affection, have been confined to a supine position by long-continued disease or debility. This state of the capillaries is called by Lerminier the 'engorgement of position;' and by Laennec, 'the pneumonia of the dying.' It neither proceeds from irritation, nor has it the essential characters of inflammation; although it is apt to be considered an evidence of inflammation by the mere morbid anatomist.

Again, as active congestion, when continued or intense, is antecedent and conducive to inflammation; so is mechanical congestion, when it reaches a certain point, the prolific source of hæmorrhage, and the almost constant precursor and immediate cause of a large class of dropsical accumulations.

I spoke a little while ago of general plethora, as a state in which the whole mass of blood circulating in the body is excessive in quantity, and rich in quality—full of colouring matter, thick with globules. But the blood, as a mass, may be in sufficient quantity, yet poor in its materials, serous, deficient in globules, and fibrin, and colour; and in this condition of the blood also, as we shall hereafter see, dropsies are apt to arise.

We have now, therefore, laid the foundation for the better understanding of those three great classes of disease—*Inflammations*, *Hæmorrhages*, and *Dropsies*.

There is no region or organ of the body exempt from these diseased conditions and their consequences; and of each of them some general account must be given, before we come to consider the special diseases incident to the several parts and organs.

But previously to entering upon this general account of inflammation, of hæmorrhage, and of dropsy, we have still some other preliminary matters of importance to discuss. The causes and modes of death. The causes of disease. A sketch of the nature, classification, and import of symptoms.

Our enquiries hitherto have related to the manner in which the physical conditions of the various parts of the body are capable of being altered in disease, and their functions disturbed or suspended. But how it happens that some of these alterations of structure, or interruptions of function, are incompatible with the further continuance of life, and put a stop to the working of the whole machine, is an enquiry of no less interest, though of a somewhat different kind.

LECTURE V.

Different modes of Dying. Pathology of Sudden Death. Death by Anæmia, its Course, Phenomena, and Anatomical Characters. Death by Asthenia, its Course, Phenomena, and Anatomical Characters. Syncope. Death by Inanition. Death by Apnœa: Death by Coma: their Course, and Phenomena, and the Anatomical Characters common to both. Application of the Principles obtained from the investigation of the Phenomena of Sudden Death, in elucidating the Symptoms and Tendencies of Disease.

I PROPOSE to devote the present lecture to the following enquiry:—wherefore it is, and how it is, that some of the corporal changes which we have been considering, or of the morbid conditions connected with those changes, come to be incompatible with the further continuance of life? how it is that they put an end to the working of the living animal machine? why the machine should not continue to work, though perhaps imperfectly, notwithstanding such changes?

When our watches stop, we take them to a watchmaker to ascertain why they have stopped. The watchmaker knows that there are various ways in which the movements of the instrument may have been arrested. The main spring may have broken; or the little chain that connects the barrel with the fusee may have parted; or the teeth of some of the wheels may have become inextricably entangled; or the watch may have ceased to go (as the saying is) simply because it has not been wound up. Now the examination which the watchmaker undertakes with respect to the watch, I am desirous of making with respect to the human body. I am going to enquire into the several processes and modes of dying—the steps, and ways, by which the vital functions of the body are extinguished. A very little experience in the sick chamber, or in the wards of a hospital, will suffice to teach you that, although all men must die, all do not die in the same manner. In one instance the thread of existence is suddenly snapped; the passage from life, and apparent health perhaps, to the condition of a corpse, is made in a moment: in another the process of dissolution is slow and tedious, and we scarcely know the precise instant in which the solemn change is complete. One man retains possession of his intellect up to his latest breath: another lies unconscious, and insensible to all outward impressions, for hours or days before life's final ending.

We seek to ascertain the mechanism and the laws of these mysterious differences.

The enquiry is not one of merely curious interest; it has a direct bearing upon the proper treatment of disease. It will teach us what we have to guard against, what we must strive to avert, in different cases. In speaking of particular diseases, I shall constantly refer to the facts and reasonings which I am now about to lay before you.

In pursuing this enquiry, we need not go into any deep physiological disquisition respecting the conditions that are essential to life. It is sufficient for our purpose to remark that life is inseparably connected with the continued circulation of the blood. So long as the circulation goes on, life, organic life at least, remains. When the blood no longer circulates, life is presently extinct: and our investigation of the different modes of dying resolves itself into an investigation of the different ways in which the circulation of the blood may be brought permanently to a stand.

Observe the ample provision that is made, in the construction of the body, for effecting and maintaining this essential function. First, there is an extensive hydraulic apparatus distributed throughout the frame—consisting of the heart and other blood-vessels. Next, there is a large pneumatic machine, forming a considerable part of the whole body—composed of the lungs, and the case in which they are lodged. Lastly, the power by which this machine is to be worked and regulated is vested in the nervous system. Each of these systems must continue in action, or the circulation will stop, and life will cease. The functions they respectively perform are, consequently, called vital functions: and their main organs—the heart, the lungs, the brain (by which I understand the intracranial nervous mass)—are denominated vital organs. The functions of any one of the three being arrested, the functions of the other two are also speedily extinguished. But the phenomena of dying vary remarkably according as the interruption begins in the one or in the other organ. Hence Bichat, who in his 'Recherches sur la Vie et la Mort,' laid the foundation of the distinctions I am about to describe, spoke of death beginning at the *head*, death beginning at the *heart*, and death beginning at the *lungs*. This nomenclature is, however, unsatisfactory and insufficient, as you will presently perceive.

That the heart may continue to propel the current of the blood, two things are necessary: first, a certain power or faculty of contracting; and, secondly, a sufficient quantity of blood in its chambers, to be moved. There are plainly, therefore, two ways in which death might be said to begin at the heart; and these require to be distinguished.

The respiration is entirely subservient to the circulation and maintenance of the blood. The two organs, the heart and the lungs, respond intimately to each other. The whole of the blood is sent by the right heart to the lungs, simply that it may there be submitted to the chemical action of the atmosphere. The respiratory apparatus is added to the body for the sole purpose of thus repeatedly ventilating the blood.

To this purpose also (setting aside all accidental impediments) two things are requisite: first, circumfused air to enter and depart at short intervals; and, secondly, alternating movements of the chest, to cause its entrance and exit.

Now these movements, although they admit of being regulated by the will, are essentially involuntary. The ordinary acts of respiration depend upon a certain condition of the medulla oblongata. If this condition fail, the mechanical part of the respiratory process, and, consequently, the chemical part also, is arrested.

The respiration hangs, therefore, directly upon the nervous system.

On the other hand, the action of the heart is not directly or necessarily dependent upon any constant nervous influence proceeding from the brain or spinal cord; but upon the ganglionic nerves that are lodged in its substance. The circulation goes on in an acephalous fœtus; it may be kept up, by maintaining artificial respiration, in a decapitated animal; nay, even when both brain and spinal cord have been removed from the body.

But though the cerebro-spinal nervous influence is not necessary to the movements of the heart—further than as it is necessary to the respiration, and to the introduction of nutriment—it has been clearly ascertained that very sudden and extensive injury or shock to the brain, operating, it is believed, through the pneumogastric nerves, may instantly paralyse the heart, and so stop its action.

Of the intra-cranial mass, then, it may be affirmed that there are certain states, which, without directly affecting the heart, bring the motions of respiration to a pause: and that there are certain other states which act directly on the heart, and arrest its play. That is, there are two different ways in which death might be said to begin at the head.

Hence, I say, the nomenclature employed by Bichat is defective and inaccurate.

In order to see clearly the steps by which the circulation, and with it life, finally terminates, in the various forms of dying, we must study the problem under its simplest forms. We must examine the cases in which the vital functions are, each in their turn, one by one, *suddenly* stopped, by some known cause, operating upon this or that vital organ. We must take advantage of the experiment (if I may so call it) which is performed before our eyes whenever a healthy man is cut off at once by external violence, or by poison, acting directly upon a particular organ or system of organs. The enquiry might be assisted, and, indeed, it has been mainly conducted, by experiments made upon living animals of similar conformation with man. But the pathology of sudden death is happily now too well understood to require any further recurrence to that painful mode of 'interrogating nature.'

Death, when it results from disease, is usually complicated. Many parts are affected, and different functions languish, and various disturbing causes are in operation, at the same time. Occasionally, however, the process of dissolution is as simple and obvious as in death produced by violence; and in most cases some primary and predominant derangement may be traced of this or that vital function; and a tendency is more or less clearly manifest to one or the other of the modes of dying, which we may now proceed to consider in succession.

And first let us examine that form of death which is caused by a want of the due supply of blood to the heart. This is called, with much propriety, *death by anæmia.*

The best examples of death taking place in this way are those in which it is the consequence of sudden and profuse hæmorrhage. The circulation fails, not because the heart has lost its power of contracting, but because blood does not arrive in its chambers in sufficient quantity.

We assure ourselves of this in two ways. In the first place, when the body of an animal is examined immediately after death from sudden and copious loss of blood, the heart is not found dilated and full of blood, as it would be if it had ceased to act from a want of power to contract upon its contents; but it is found empty, or nearly so, and *contracted.* Secondly, this conclusion is confirmed by the reverse experiment: by the effect, I mean, of the *transfusion* of blood. It is a fact well ascertained, first by experiments made upon animals, and afterwards by most happy trials upon the human subject, that in cases of apparent death from copious hæmorrhage the suspended functions may be restored by conveying a timely supply of blood into the vessels of the seemingly dead animal from the veins of a living animal of the same species. Now it is quite clear that this introduction of fresh blood could be of no avail in a case where the heart was unable to act upon the blood which had already reached it.

The phenomena which attend this mode of dying are paleness of the face and lips, cold sweats, dimness of vision, dilated pupils, vertigo, a slow weak irregular pulse, and speedy insensibility. With these symptoms are frequently conjoined nausea, and even vomiting, restlessness and tossing of the limbs, transient delirium; the breathing is irregular, sighing, and, at last, gasping; and convulsions generally occur, and are once or twice repeated, before the scene closes.

It is thus that women often die, in whom ‘flooding’ happens after childbirth. Sometimes the sudden bursting of an aneurism occasions this form of death. It is common on the field of battle, and in accidental injuries whereby large blood-vessels are wounded. Internal hæmorrhage, depending upon diseases hereafter to be described, may also prove fatal in the same manner.

This, then, is one form of death, beginning at the heart. Another form, the converse of this, but spoken of also as death beginning at the heart, is that in which there is no deficiency in the supply of blood to the heart, but a total failure of contractile power in that organ. This is well denominated *death by asthenia.*

Death occurring in this way is not uncommon. The effects of some kinds of poison furnish a good illustration of it. There are certain substances which, applied to some part or other of the body, speedily extinguish life: and when, after their fatal operation, the thorax is opened, each chamber of the heart is found to be filled with its proper kind of blood, upon which it has been unable to contract.

This was distinctly made out by Sir Benjamin Brodie, in his able and scientific investigation of the effects of different poisons. You may read with advantage his papers on this subject in the

'Philosophical Transactions' for 1811 and 1812. He ascertained upon examining the chest after death occasioned by the *upas antiar*, that the heart was not empty, but full; there being purple blood in its right, and scarlet blood in its left cavities. These are the anatomical characters of this kind of death; and they prove that the action of the heart has not ceased from the want of blood to be propelled, but from a loss of the heart's contractile power. And disease may kill in exactly the same manner. In the progress of that gradual fatty degeneration of the muscular tissue of the heart which was briefly mentioned in my third lecture, its power to contract sometimes ceases on a sudden, and the patient dies at once.

The state of suspended animation common to both these forms of dying—(the ultimate external phenomena being nearly the same in both, and the result in both being the simple failure of the circulation)—is often expressed by the term *syncope*.

Besides the essential distinctions between them already mentioned, there is this further point of difference. In death by anæmia, the suspension of the functions of the nervous system arises from a lack of the blood which should be sent to the brain from the *heart*. Hence the well-known effect of mere position. Syncope is sooner produced by venæsection when the person bled is sitting up than when he is recumbent: and the first remedy for the fainting state is to lay the patient flat upon the ground, or even to place his head a little lower than the trunk of his body. In the one posture the current of the blood towards the head is impeded by the force of gravity; in the other it is not. In sudden death by asthenia this order is reversed; the *nervous system* is the part first affected, and through it, consecutively, the heart. This appears from the fact that sudden death by asthenia is sometimes produced by causes which we know to act primarily upon and through the nervous system; by strong mental emotion—as intense grief, joy, terror. Instances of fatal concussion, where the brain is jarred by some bodily shock—and death occurring almost in a moment from blows on the epigastrium—are of this kind. In the former case the mortal influence is conveyed through the pneumogastric, in the latter probably through the ganglia of the great sympathetic nerve. Lightning and electricity kill too, when they kill at all, in the same way. And we shall hereafter see that certain varieties of apoplexy, and several other diseased conditions, destroy life by suddenly arresting the contractile power of the heart.

When death by asthenia occurs more slowly, from disease, the phenomena are somewhat different. The pulse becomes very feeble and frequent, and the muscular debility extreme; but the senses are perfect, the hearing is sometimes even painfully acute, and the intellect remains clear to the last. The tendency to death of this form is remarkably manifest in acute inflammation of the peritoneum, and in cases of extensive mortification.

Akin to this form of dying is that in which the living powers are slowly exhausted by lingering and wasting disorders, as in many cases of phthisis, in diabetes, and in dysentery; or by hæmorrhages moderate in amount, but frequently repeated; or by any other long-continued drain upon the system. The death is partly, however, to be ascribed to a deficient supply of healthy blood to the heart. The type of these mixed modes of dying is seen in *death by starvation*, which may be considered intermediate between death by anæmia and death by asthenia. Death from inanition can never be sudden. Two factors go to its production. Renewed no longer from without, and recruited only by absorption from the system itself, the blood diminishes gradually in quantity, while its composition deteriorates. Less blood, and blood of worse quality, passes through the coronary arteries to the tissues of the heart. The contractile power of the ill-fed organ, as well as that of the muscles generally, is gradually weakened; and from these combined causes its movements at length cease. Accordingly, after death by starvation the heart is not found to be so much contracted, nor so nearly empty, as after death by sudden and copious hæmorrhage.

Certain diseases of the throat or of the œsophagus, prohibiting the introduction of food; of the stomach, preventing its retention; of the digestive organs generally, hindering its assimilation, are fatal in this manner.

We have yet to consider how death is produced by the suspension of the respiratory function—in other words, by a want of the due arterialisation of the blood.

There are two perfectly distinct modes in which this cause of death may proceed; distinct, I mean, in regard to the steps of the process, although identical in regard to the ultimate result.

1. When the access of air to the lungs is suddenly denied by some direct obstacle to its entrance;

2. When the muscular actions required for breathing cease in consequence of *insensibility*, caused by disease or injury of the brain.

The first of these two forms of dying is commonly called death by *asphyxia*. The second is conveniently termed death by *coma*. Bichat spoke of them respectively as death beginning at the lungs, and at the head.

It is of much importance to get rid, when we can, of unsuitable names. They are very apt to warp our notions concerning the real nature of the things which they are intended to express. This term *asphyxia*, though in everybody's mouth, is very inappropriate, if we look to its etymology, to the kind of death which it has come to denote. It signifies literally, you know, pulselessness, the absence of pulse; and therefore it *might* express any kind of death whatever; or if applied to any particular *mode of dying*, it would seem to belong to that which we have just been considering, namely, death beginning at the heart. And you will presently see that it is *peculiarly* inapplicable to all those cases where death results from the non-arterialisation of the venous blood. Its current signification has, I am afraid, been too long established by custom, to allow of its being restored to its proper meaning without much confusion. But, at any rate, I can and shall avoid its use, and adopt in preference the generic term *apnœa* (privation of breath) as justly expressive of the mode of death to which the word asphyxia is commonly given by authors. The generic English term is *suffocation.*

The entrance of air into the lungs may be prevented in various ways: by stoppage of the mouth and nostrils (*smothering*) :—by submersion of the same inlets in some liquid (*drowning*); or in gases which, though not in themselves poisonous, contain no oxygen; such are hydrogen and azote :—by mechanical obstruction of the larynx or trachea from within, as by a morsel of food (*choking*), or from without, as by the bowstring (*strangulation*; both these varieties are included in the term *throttling*) :—by forcible pressure made at once upon the chest and abdomen, preventing all movement of the ribs and of the diaphragm; this happens sometimes to workmen employed in excavating, who are buried, their heads excepted, by the falling of a mass of earth; it was near happening, Dr. Roget tells us, to an athletic black man, of whose body, as an academic model, an attempt was made to take a cast, by one operation, and in one entire piece; 'as soon as the plaster began to set, he felt on a sudden deprived of the power of respiration, and to add to his misfortune, was cut off from the means of expressing his distress; his situation was just perceived in time to save his life;' in this way the victims of Burke and Hare were stifled; and the same immovable state of the lung-case is sometimes produced in tetanus, or by the poisonous influence of strychnine, all the respiratory muscles being fixed in rigid spasm:—by paralysis of the same muscles, from injury or disease of the spinal cord above the origin of the nerves that give off the phrenic nerve, and therefore above the origin of the intercostal nerves also; or from section of the phrenic and intercostal nerves:—lastly, by such breaches in the walls of the thorax as admit air freely to the surface of both lungs, and spoil the pneumatic machine, as a pair of bellows is spoiled when deprived of its valve. Of course the same consequences ensue when both pleuræ become filled with liquid of any kind.

Whenever the privation of air is sudden and complete, the following external phenomena present themselves:—Strong but vain contractions occur of all the muscles concerned in breathing, and struggling efforts to respire are made, prompted by that uneasy sensation which everyone has experienced who has tried how long he could hold his breath, and which, when unappeased, soon rises to agony. This extreme distress is transient, being almost immediately succeeded by sensations, not unpleasant, of vertigo, and then by loss of consciousness, and convulsions; at length all effort ceases, a few irregular twitchings or tremors of the limbs alone perhaps remaining; the muscles relax, and the sphincters yield; but still the movements of the heart, and even the pulse at the wrist, continue for a short time after all other signs of life are over; there is no *asphyxia* (properly so called) till the very last.

During this process, which does not occupy more than two or three minutes, the face at first becomes flushed and turgid, then livid and purplish, the veins of the head and neck swell, and the eyeballs seem to protrude from their sockets; at length the heart ceases to palpitate, and life is extinct.

The internal changes, which correspond with and cause these outward symptoms, have been carefully studied, and accurately, though slowly and lately ascertained. They all proceed from the prevention of the chemical alteration naturally produced in the blood, within the capillary vessels of the lungs. The blood, continuing venous, passes at first in considerable quantity through the pulmonary veins, into the left side of the heart, and thence through the arteries, to all parts of the body. This venous blood however, loaded with carbonic acid, is inadequate to sustain, or sufficiently to excite, the functions of the parts it thus reaches. In the brain the effect of the unnatural circulation is felt at once; and shown by the convulsions and insensibility that ensue. The motion of the blood towards the lungs is also stopped just before it reaches their capillaries: the pulmonary arteries remain full and the right chambers of the heart are distended, while venous congestion becomes general. The dark and languid stream which flowed at first into the left chambers moves more and more tardily and scantily, and leads by its unnatural quality, as well as by its deficient supply, to feeble contractions; and this side of the heart is comparatively empty.

In this state, even after the heart has ceased to beat, but not *long* after, if the cause which has excluded the air be withdrawn, and fresh air readmitted—in other words, if artificial respiration be instituted—the arrested blood undergoes the required change, becomes arterial, begins again to pass onwards, and by degrees the circulation is restored, and the sufferer saved.

In this mode of death, the circulation is first arrested, and death truly begins, *in the lungs.*

When the carcass of an animal that has thus perished of apnœa is immediately afterwards examined (so speedy an inspection of the human body being, for obvious reasons, seldom practicable or proper), the left side of the heart is found to contain a small quantity of dark blood, while its right cavities are greatly distended, and the pulmonary arteries, the cavæ, and the whole venous system, are gorged with blood of the same character. These are, in few words, the anatomical characters of sudden death by apnœa.

The pathology of this mode of dying has, I say, been thoroughly understood only of late. It will not be uninteresting, and may, I think, be useful, to trace briefly the successive steps by which the true explanation has been attained. Haller was of opinion that the quiescence of the lungs, consequent upon the cessation of the alternate movements of the thorax, formed a mechanical impediment to the further transit of blood through them; and that death resulted from obstruction of the circulation *in the lungs.* He was partly right; but he erred in supposing that the stream of blood was arrested mechanically by the motionless condition of the lungs. If atmospheric air be excluded, apnœa occurs, with all its peculiar phenomena, although the lungs may continue to play; as in persons who breathe azote or hydrogen gas. It was clearly shown by Dr. Goodwin, in his 'Essay on the Connection of Life with Respiration,' that the unaërated blood passed at first through the lungs, and entered the left auricle and ventricle of the heart; but he thought that it went no further. His notion was that arterial blood is the only stimulus which can excite the contraction of the left cavities of the heart, and that when venous blood arrives in them, the organ becomes motionless; and no blood being sent to the brain, the person dies. Had this theory been true, the left chambers would be found full of blood after death (which they are not), and the mode of dying would not have differed essentially from that which we have already considered as death by asthenia. The well-devised experiments of Bichat carried the investigation a step further, and proved that the unaërated blood not only reached the heart, but was propelled at first by the contractions of that muscle to every part of the body, through the arteries. Having put a ligature upon the trachea of a living animal, he made a small opening in one of its carotid arteries. Presently the slender stream of blood that issued began to lose its florid tint, and to assume the dark colour of venous blood; but *it continued to flow*, and the afflux of this dark blood upon the brain was marked by convulsions and insensibility. Bichat conceived, therefore, the erroneous notion that the blood suffered *no* obstruction to its passage through the lungs, but that, remaining unpurified and venous, it acted as a poison upon every part to which it was carried by the arteries—first upon the nervous system, and ultimately (passing through the coronary arteries) upon the muscular substance of the heart itself. There are, however, two well-known facts, which upon this theory would be inexplicable—the comparative emptiness of the left chambers of the heart, and the restoration of the suspended functions by the timely performance of artificial respiration. The air could never reach and revivify or depurate the venous blood, stagnating in the capillaries of the heart. Bichat's unsound doctrine was corrected, in part, by Dr. Kay,* who held that the blood begins to stagnate in the capillaries of the lungs, in consequence of its failing to undergo the change from venous to arterial; and that the movements of the left heart are brought to an end, principally by the defect in the supply of blood from the lungs. His experiments tend moreover to prove that venous blood circulating through the arteries has no directly poisonous operation, but is capable, though much less effectually than arterial blood, of supporting in some degree the irritability of the muscles. A muscle will continue to contract longer when supplied with venous blood by its arteries, than when supplied with no blood at all. Doubtless in death by apnœa the movements of the heart are weakened, partly in consequence of the imperfect stimulus afforded by the venous blood that penetrates its substance.

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* Now, Sir James Kay-Shuttleworth.

But Dr. Kay, in his turn, fell somewhat short of the full solution of this interesting problem. It was reserved for Dr. George Johnson to suggest that when the conversion of venous into arterial blood in the pulmonary capillaries is suspended, the stream of dark blood is arrested by what he happily calls the stop-cock action of the ultimate pulmonary arteries. It had been ascertained, by various trustworthy observers, that if the thorax of an animal which has been suddenly strangled by a tight ligature placed upon its windpipe, be examined immediately after death, the lungs are always found empty of blood, while there is vast engorgement of the right heart, of the great veins, and of the pulmonary artery up to its minutest ramifications. Dr. Johnson proved, by experiments of his own, that this is so, whether the ligature be applied after or before a full inspiration, whether, that is, the lungs were at the time full or comparatively empty of air. These are the plain and unquestionable facts of the case. They show that some opposing power must have been called into play, more than equal to the propelling power of the right ventricle of the heart. Now such a power—and it is the only conceivable one—actually exists at the very place where the venous current meets with its curb: and it consists in the firm contraction of those muscular fibres of the minute arteries, the function of which it is to regulate the blood-supply in accordance with the varying requirements of the part. This function again is determined by those unsleeping sentinels, the (vaso-motor) nerves. Were it allowable, for the sake of illustration, to impersonate the vital forces concerned in this marvellous adaptation, we might liken the process to the intelligent stopping of the traffic on an obstructed line of railway by a backward telegram.

Or take another illustration. The blood passes into the pulmonary capillaries in order that it may be aërated. Whenever this process of aëration is suspended, a nervous signal is sent from the capillaries to the minute pulmonary arteries, enjoins their contraction, and thus stops the blood stream. The purpose of the arterial spasm is to prevent the flow of blood into the pulmonary capillaries upon the cessation of the function of respiration. If the stop-cock of a gas-burner could be made self-acting, so as to maintain at all times a constant and exact relation between the supply of fuel and the rate of combustion, and so as, further, to turn off the gas and prevent its escape when by any accident the flame is extinguished—that would represent with sufficient accuracy the working of the living arterial stopcocks in the lungs.

Sudden death by apnœa is not very often witnessed as the result of disease. It sometimes is caused by a spasmodic closure of the rima glottidis. It is no uncommon consequence of accidents, in which the upper cervical vertebræ are broken or displaced. I have seen several instances of death rapidly produced, with all the symptoms of sudden suffocation, generally in intoxicated persons, in whom the chink of the glottis has been found closely plugged by a fragment of meat, which 'had gone the wrong way.'

But there are numerous forms of more chronic disease, in which the tendency to death by apnœa is plainly discernible, sometimes for a long while before their fatal termination arrives. And the phenomena are similar in character to those which are noticed when the struggle is short. We hear the patients complain of the 'want of breath.' We see how they labour to satisfy this want, when it becomes urgent, by the elevated shoulders, the dilating nostrils, the energetic action of all the muscles that are auxiliary to the respiration. We perceive by the dusky and loaded countenance, the livid lips, and ears, and eyelids, that the blood is but imperfectly arterialised. The diminished capability of such blood to support the functions of the brain is made evident by the vertiginous sensations and the delirious thoughts of the gasping sufferers; and after death we find the same distension of the right chambers of the heart, while the left are nearly empty—the same gorged condition of the pulmonary arteries and venous system generally, which constitute the anatomical characters of this mode of dying. These appearances are even more constantly visible in the dead body, when apnœa has been gradually produced, than after sudden suffocation; simply, I believe, because they are more *permanent*. After sudden death, however caused, the blood seldom coagulates; and the venous turgescence consequent upon rapid apnœa, although great at first, has time to subside and disappear before the body is examined.

In protracted cases, death does not take place purely in the way of apnœa; the heart is weakened, and the nervous influence impaired, by the continued circulation of imperfectly arterialised blood; but the symptoms belonging to apnœa are plainly predominant.

When (as is most common) the privation of air is incomplete, and a scanty and insufficient supply is admitted, morbid changes take place in the lungs themselves; the air-tubes and cells become charged with serous fluid, which operates as an additional cause of suffocation. The same phenomenon is observed when the par vagum is divided on both sides.

Death by apnœa in disease is extremely common. It may be produced by anything which narrows the chink of the glottis; by warts that sometimes grow there, by œdema of the submucous tissue of the larynx, by inflammatory tumefaction of its lining membrane: it may result from the presence of what are called false membranes in the windpipe and bronchi, such as are formed in the distemper named croup, and sometimes in diphtheria: it may be the consequence of disease situate in the substance of the lungs themselves, rendering them incapable of receiving the requisite quantity of air; of this we have examples in pneumonia, and in pulmonary apoplexy: or it may proceed from disorders of the pulmonary mucous membrane, the air passages becoming clogged with excessive and unnatural secretions, or shut up in collapse, as in bronchitis. Phthisis is sometimes fatal in the way of apnœa; more commonly it tends to death by asthenia. Diseases of the pleuræ attended with effusion, and causing pressure upon the lungs; diseases of the heart and great thoracic blood-vessels, affecting the quantity of blood in the same organs; even certain abdominal maladies, accompanied by swelling, and thrusting the diaphragm upwards—terminate by the same mode of dissolution.

There is yet another way whereby the 'circulation may be brought permanently to a stand,' which cannot properly be spoken of as death by asthenia, for there is neither any failure in the propelling force of the heart, nor any loss of blood from the body; nor yet as death by apnœa, for there is no privation of air to the lungs: but which depends upon a mechanical block in the trunk of the pulmonary artery. I allude to the case—not a very uncommon one—in which a clot of fibrin, either brought from a distant vein, or formed within the right chambers of the heart, gets into the venous stream, and plugs, on reaching it, the pulmonary artery. If the obstruction be complete, death may be instantaneous. If the vessel be not perfectly sealed, extreme dyspnœa with pallor and faintness comes on at once, and the patient dies within a period varying from a few minutes to several hours.

It is remarkable that an impediment to the supply of blood to the lungs through the pulmonary artery causes dyspnœa as urgent as an impediment to the supply of air to the lungs through the air-passages. Physiologically this is explicable by the want, common to both cases, of aërated blood by the system; expressing itself in the chemical cry from the famishing tissues for the indispensable oxygen.

What is peculiar to this mode of dying is that the circulation is stopped, yet not by asthenia; and the function of respiration is suspended, yet not by apnœa. Death does really in this case begin in the lungs, and the mode of dying may with literal accuracy be called death by *pulmonary asphyxia*—or pulselessness in the pulmonary artery.

Death by *coma*, although common enough, and of much importance to be understood, needs not detain us long. Certain morbid states of the brain (it is unnecessary at present to enquire into their nature and origin) produce stupor, more or less profound; the sensibility to outward impressions is destroyed, sometimes wholly and at once, much oftener gradually; the respiration becomes slow, irregular, stertorous; all voluntary attention to the act of breathing is lost, but the instinctive motions continue; the stimulus conveyed by the pulmonary branches of the eighth pair of nerves, and probably by certain branches too of the fifth, still excites, though perhaps imperfectly, the reflex power of the medulla oblongata, which sustains the involuntary movements of the thorax. At length this function fails also—the chest ceases to expand—the blood is no longer aërated—and thenceforward precisely the same internal changes occur as in death by apnœa.

You will observe that the extinction of *organic* life takes place in exactly the same manner in both cases; the difference between the two forms of dying being this—that in death by apnœa, the chemical functions of the lungs cease first, and then the circulation of venous blood through the arteries suspends the sensibility; whereas, in death by coma, the sensibility ceases first, and in consequence of this the movements of the thorax, and the chemical functions of the lungs, cease also. So that the circulation of venous blood through the arteries is in the one case the cause, and in the other the effect, of the cessation of *animal* life.

The causes that destroy the sensibility leave no constant or necessary traces of their operation. The essential anatomical characters of death by coma, and of death by apnœa, are therefore the same.

Death occurring in the way of coma has this peculiar kind of interest belonging to it, that it may sometimes be effectually obviated by a mechanical expedient. The circulation ceases because the actions of respiration cease—and the failure of the actions of respiration arises from a suspension of the nervous power. If it be merely a suspension—if the nervous functions pause within the verge of recovery—organic life may be sustained by the performance of *artificial* respiration, until the insensibility has passed away; and thus the danger to life, which depended on that insensible state, may be escaped.

Many years ago, in the course of those researches to which I have already referred, Sir Benjamin, then Mr. Brodie, was led to think that by continuing the respiration artificially in animals labouring under the influence of narcotic poisons, the heart might be kept in action until the stupefying but transitory effect of the poison upon the brain had gone off. This idea he soon brought to the test of experiment, and the result was such as to justify his ingenious reasoning. He inserted some woorara into a wound which he had made in a young cat. After a certain time the respiration had entirely ceased, and the animal *appeared to be dead*, but the *heart* could still be *felt beating*. The lungs were then artificially inflated about four times in a minute. The heart continued to beat regularly. When the artificial breathing had been kept up for forty minutes, the pupils of the cat's eyes were observed to contract and dilate upon the increase or diminution of light, but the animal remained perfectly motionless and insensible. At the end of an hour and forty minutes there were slight and involuntary contractions of the muscles, and every now and then there was an effort to breathe. At the end of another hour the animal, for the first time, showed some signs of sensibility when roused, and made spontaneous efforts to breathe twenty-two times in a minute. The artificial breathing was, therefore, now discontinued. She lay, as in a state of profound sleep, for forty minutes longer, when she suddenly awoke, and began to walk about.

Sir Benjamin Brodie had indeed been anticipated in this happy proposition for recovering persons apparently dead after taking narcotic poison, after submersion, and the like—although he does not seem to have been aware of it. The experiment had once been tried before, and on the human subject, and with success, though not upon such scientific principles. The case is given by Mr. Whately, in the 'Medical Observations and Inquiries,' vol. vi. A man who had swallowed an immense quantity of solid opium, and who seemed to be dead, was restored by the patient perseverance, on the part of his medical attendants, in a process of artificial breathing.

It is seldom that we can hope for success from this expedient in the treatment of disease; simply because, in most cases, the injury of the nervous system which has produced the insensibility is irretrievable.

In most forms of apoplexy, and of hydrocephalus, death occurs in the way of coma. Sometimes, however, as I mentioned before, the damage to the nervous substance is so extensive and sudden, as to operate like a shock, and cause death by asthenia. The tendency to death by coma is also strongly pronounced in sundry affections of the brain, both acute and chronic. These will form subjects for our consideration hereafter.

The several modes of dying, then, in cases of sudden death, are clearly enough made out. Let me briefly sum up the conclusions at which we have arrived. Life cannot be maintained without the circulation of arterial blood: and whenever a person dies, he dies either because *no* blood circulates through his arteries, or because *venous* blood circulates through them.

When it comes to pass that no blood is circulated through the arteries, we say that death occurs in the way of syncope; and this is of two kinds. In the one there is not blood enough received by the left side of the heart to be sent onwards by the contraction of its chambers, either because there is a deficiency of blood in the system, or because its passage through the pulmonary artery is barred; in the other there may be blood enough, but the heart has not sufficient power to contract upon it.

Also there are two ways in which death may be brought about in consequence of the circulation of venous blood through the arteries. In one of these, the first step is the sudden shutting out of air from the lungs; the blood which arrives in those organs is not aërated, or rendered arterial, but circulates again as venous blood, producing a failure of the animal functions, and weakening the muscles, and presently stagnates in the pulmonary arteries. In the other, the animal functions are the first to suffer—insensibility occurs—the power which governs the movements of respiration is in abeyance—the breathing ceases—and organic life is extinguished as in the former case.

I trust you even already perceive that a right understanding of these matters is calculated to throw both light and interest upon our study of the symptoms, and of the tendencies, of disease. It will enable us to aim with more precision at fulfilling the indication so often inculcated by Cullen, of 'obviating the tendency to death.' In this sketch I have merely been able to hint at the important bearings of such views upon our practice. My attention was first called to them by the lectures of my respected instructor, Dr. Alison, who was accustomed to illustrate them by reference to the phenomena of one large class of disorders. All the modes of dying that I have described are apt to take place in *fevers*. Sometimes we have to combat the one, sometimes the other tendency. The disease often proves fatal in the way of coma; this happens principally when the brain has been a good deal affected, when there has been much headache, delirium, and stupor: sometimes, when the lungs have been seriously implicated, life is extinguished in the way of suffocation or apnœa: and occasionally fever seems to terminate fatally in the way of syncope, especially when the stress of the disorder has fallen upon the bowels, when there has been continued diarrhœa, and ulceration of the intestinal glands. Or if death do not occur precisely in these ways, at least it resembles more in different cases, sometimes one form of dying, sometimes another.

It is notorious that very different remedies, and even different plans of treatment, have been strongly recommended, in fevers, by different practitioners. Of this diversity in practice and opinion it is a probable explanation that one plan has been found the most proper to avert the fatal event in one form of the disease, and one in another. The tendency to a particular mode of death will prevail in, and characterise, a whole epidemic. We shall resume these considerations hereafter: in the mean time the facts we have been reviewing may teach us the danger of applying, with too much confidence, the experience we may have gained of one epidemic to the treatment of another; and the risk we sometimes incur of misjudging, and of criticising unjustly, the practice recommended by other physicians, because it does not apear to accord with the results of our own observation.

LECTURE VI.

Causes of Disease: distinction between predisposing and exciting causes. Enumeration of causes, as connected with the Atmosphere—Food and Drink—Poisons—Exercise—Sleep—Mental and Moral Conditions—Hereditary Tendencies—Malformations. Temperature. Effects of Heat and of Cold.

THE *causes of disease* are commonly arranged under three heads—as predisposing, exciting, or proximate.

Of these three, the last mentioned, or the *proximate* cause, is nothing else than the actual disease itself—the actual condition of that part of the body, from which the whole train of morbid phenomena essentially flows. When we know that part, and that condition, we name the disease accordingly. It may be *inflammation* of the *lungs*; or *softening* of the *brain*. When we do not, we call the complaint after the group of symptoms by which it is characterised; *intermittent fever*, perhaps; or *marasmus*. The term 'proximate cause' is, therefore, an unnecessary term: it is moreover, to learners, a puzzling term, and tends to give to the study of disease a scholastic and repulsive aspect. I wish you to get into the habit of contemplating the whole science of medicine under its simplest and plainest form. I am sure we may very well banish the term 'proximate cause' altogether; and having now given an explanation of its meaning, for your guidance when you meet with it in books, I shall never employ it, in these lectures, except perhaps in a quotation, again.

Let me say, too, that I use the word *cause* in its popular sense. Philosophers tell us that we know nothing, that we can know nothing, of cause and effect: that we may indeed watch the march of phenomena, and so ascertain the laws of their procession and sequence. But we may not affirm that one event is the effect of another which invariably precedes it, nor the cause of another which always follows it, any more than that because the letters of our English alphabet are always arranged in the same particular order, B is therefore the effect of A, or the cause of C. Be it so. Nevertheless I must use, and you will understand, the terms cause and effect in the old vulgar way.

In strictness of language, one event is held to be the cause of another event which follows it when the first being absent, the second never occurs; and the first being present, the second never fails to occur, unless some other event intervene to prevent it. But the causes of disease will not bear to be spoken of after so strict a fashion. We perceive that certain external circumstances (*quæ nos circumstant*) often precede such and such diseases; and that the diseases seldom happen when the same circumstances have not been previously observable; and we begin to regard those circumstances as exciting causes of those diseases. We find that the diseases are much more frequent among persons known to have been exposed to the agency of the suspected causes, than among persons who are not known to have been so exposed. The evidence at first is presumptive only. But the more uniform their conjunction, and the more rare their disjunction, the more confidently do we assign to the two consecutive events the relation of cause and effect. By this kind of observation a number of exciting causes of disease have been clearly established to be such.

But recollect, certain circumstances being present, such and such diseases do *often*, not *always*, follow. Some persons are more liable to be affected by the operation of many of these ascertained causes than others are; and the same person is more liable to be influenced by the same cause at one time than at another. And special circumstances, existing in particular cases, will be found to account for this variable operation of known exciting causes upon the bodily health. The special circumstances may properly be called *predisposing causes*. Thus, of twenty persons exposed to the same noxious influence—to the combined agency of wet and cold during a shipwreck for example—one shall have catarrh, another rheumatism, a third pleurisy, a fourth ophthalmia, a fifth inflammation of the bowels, and fifteen shall escape without any illness at all. A man does that with impunity to-day, which shall put his life in jeopardy when he repeats it next week. It is not, therefore, the exciting cause *alone* that in all cases determines the disease. Something—nay much, or all—will frequently depend upon the *condition of the body* at the time when the exciting cause is applied; and this condition of the body, which we call *predisposition*, results from circumstances then or previously in operation: and these circumstances are, in our language, *predisposing causes.*

Do not confound, as many seem to do, the predisposition with the circumstances creating it. The predisposition is a certain state of the body—the predisposing cause is what produces that state. The *cause* of the predisposition is the *predisposing cause* of the disease. Predisposition means something more than, and beyond, the mere common capacity of being affected by the exciting cause. A predisposing cause may therefore be defined to be anything whatever which has had such a previous influence upon the body as to have rendered it unusually susceptible to the exciting cause of the particular disease.

It is sometimes difficult, or impossible, to say of a given cause whether it ought to be ranked among the exciting or among the predisposing causes: whether it have prepared the system for being affected by some other agent, or whether it have itself produced the disease; but for the most part the distinction is real, and sufficiently well marked, and of great importance to be attended to.

Disease may sometimes be averted, even in despite of strong and fixed predisposition to it, if we know, and can guard against, the agencies by which it is capable of being excited. A man may inherit a proclivity to consumption, yet fortunately escape that fatal complaint by timely removal to a mild, dry, and equable climate, and by other suitable precautions; that is, by avoiding whatever tends to rouse the dormant tendency into action. On the other hand, disease may often be warded off, notwithstanding the presence and application of its exciting cause, when its predisposing causes are ascertained and can be prevented. In proportion as the body is weakened or exhausted, it yields more readily to the pernicious influence of contagion, or of malaria; but by obviating all causes of debility, and fortifying the system, we walk with comparative security amid surrounding pestilence.

Diseases sometimes occur when no exciting cause, when no cause at all, has been apparent. All that we can say of such cases (which are not, however, very frequent) is, that the causes have not hitherto been discovered.

Now the ascertained causes of disease are many and various. Whatever ministers to life, health, or enjoyment, may become, under changing circumstances, the medium of pain, disease, or death. The earth on which we live and move, the atmosphere in which we are constantly immersed, abound with dangers. Both the organic and the inorganic world of matter around us are full of poisons; they lurk in our very food, which becomes pernicious when taken in excess, or when it consists of certain substances, or certain admixtures of substances; so that there really was much truth, as well as some humour, in the startling motto to Mr. Accum's book on adulterations—'*There is death in the pot.*' The teeming life by which we are everywhere encompassed fastens parasitically upon our bodies as its prey. Our passions and emotions also, nay, even some of our better impulses, when strained or perverted, tend to our physical destruction. The seeds of our decay are within as well as around us.

Let us enumerate, however, a little more particularly, the various known sources of disease, with the view of making, afterwards, a few practical comments upon some of them.

I shall pass over, in this enumeration, nearly all *chemical and mechanical injuries*; inasmuch as these belong to surgery.

If we look to atmospherical causes, we shall find that those varieties in the state of the air which proceed from mere differences of degree in its natural qualities may be productive of disease. Such are, extremes of heat and of cold; sudden variations of temperature; excessive moisture or excessive dryness; different electric conditions; differences of pressure as measured by the barometer; a deficiency of light.

On the reality and force of some of these influences, trivial as they may seem, it is needless to insist. They make themselves felt even when they fall short of causing absolute disease. Who has not been sensibly conscious, in this great city especially, of the relief and exhilaration of spirits which immediately follow the sudden dispersion of a dense fog, and the reappearance of a clear sky and bright sunshine? There are few, again, who have not experienced the opposite feelings of depression, the mental answering to the atmospheric gloom, the languor, uneasiness, and discomfort which on a sultry day in summer precede, and are chased away by, the explosion of a gathering thunderstorm.

Again, the atmosphere may be a source of disease in consequence of its being loaded with impurities. Malaria, proceeding from the earth, contagions of various kinds, and noxious gases in general, may be considered as so many poisons.

Under the head of *nutriment* we may place the use of food of which the quality is bad and hurtful; this cause also strictly belongs to the class of poisons. Again, an insufficient supply of healthy food. And still more common causes are *excess in eating* and *intemperance in drinking*.

The numerous *poisons* which are not comprehended under either of the foregoing heads are also prolific sources of disease.

Another great class among the causes of disease might be formed by considering together the influence of various *trades and avocations* which are directly injurious to the health of those who pursue them.

We know, by ample experience, that a certain amount of bodily *exercise* is essential to good health. We see the evil consequences of much overstepping that amount, in the deformities and disorders which result from labour too severe, or too long continued. But a much more numerous train of complaints follow the opposite state—that in which, from indolence, or from necessity, but *little* exercise is used.

Excessive indulgence in sleep on the one hand, and long-continued want or interruption of repose on the other, are apt to give rise to serious maladies.

Very many diseases have a mental origin. Excessive intellectual toil—the domination of violent passions—the frequent recurrence of strong mental emotion—vicious and exhausting indulgences—each and all will sap the strength, and grievously impair the health of the body: and perhaps there is no cause of corporal disease more clearly made out, or more certainly effective, than protracted anxiety and distress of mind.

When we add to this catalogue of the sources of disease all those morbid tendencies which are *hereditary*—and those which flow from original *malformation*, and are congenital—we shall have a tolerably complete list of the manifold dangers to which our mortal frames are continually liable.

There are several points of view under which the consideration of these causes of disease might be shown to be interesting. We might enquire, for example, which of them are commonly predisposing, which exciting, causes; and what are the circumstances which are found to render the same agent at one time merely a predisposing, and at another time an exciting cause.

We might also separate, with some advantage, those causes of disease to which the human body is often and necessarily exposed, from those which consist in agencies that are of local or temporary existence only. But without multiplying these artificial distinctions, I shall take occasion to advert to them either when speaking more in detail of particular causes, or when speaking of the disorders they have produced.

In our investigations into the causes of disease, great caution is necessary in order to avoid being misled by individual cases. The circumstances capable of influencing the bodily health are so various—so many of them are apt to be in operation at the same time—and so little power have we of excluding them, one after the other, so as to ascertain the exact efficacy of each—that our observations respecting their relative or their actual effects are open to much fallacy. We endeavour to escape this source of mistake by repeating and multiplying our observations. But it is by tracing diseases as they affect considerable masses of men, placed as nearly as possible under the same external circumstances, that we gain the surest and most satisfactory evidence in respect of the causes of disease. And hence it is that the experience of the medical officers of our fleets and armies is so valuable. Dr. Alison has well remarked, that all the circumstances of the whole number of men whose diseases fall under the notice of military and naval practitioners are, in many respects, exactly alike: the men are generally healthy adults in the first instance; the circumstances in which they are placed are thoroughly known to the observer, and indeed are often to a certain degree at his disposal; they are often suddenly changed also, and changed sometimes as to one portion of the whole mass of individuals, while they remain unchanged as to another portion; so that his opportunities of observation partake in some measure of the nature of experiments, and being made upon a large scale, they are especially interesting and conclusive. In point of fact a great deal has been learned, with absolute certainty, upon this subject.

Hitherto I have simply *enumerated* the principal causes of disease; but conceiving a bare enumeration of this kind to be of little use, I shall enquire somewhat more nearly into the nature and mode of operation of several of them *now*: of others I prefer to speak in connection with the particular diseases to which they give rise.

You will not consider the enquiry superfluous. To know the cause of a disease is sometimes to be able to *cure*, often to be able to *prevent* it. In some cases the cause is beyond our power, but an acquaintance with its nature may teach us how to moderate or to remedy its consequences. There are many diseases over which medicine has very little control, but the causes of which, when ascertained, may be avoided, counteracted, or extinguished. Such causes, when they do not happen to be removable by individual efforts, are often susceptible of extinction by the united measures of a community. For this reason it is very desirable that correct opinions respecting the causes of disease should be widely diffused among the public;—and there is no way in which information of this kind is so likely to be made generally known, as by communicating it to medical students who are about to scatter themselves in all directions over the face of the land.

I shall proceed, then, in the first place, to the consideration of *heat and cold*, as external agencies capable of producing disease.

The range of atmospheric temperature compatible with human life is very considerable. Its limits are probably just those extremes of heat and cold that belong to the lower strata of the air in the different parts of the planet on which man is destined to exist. Under the burning sunshine of the tropics, and amid the profound frost of the polar regions, we alike find human dwellers. These different degrees of external temperature impress indeed peculiar physical characters upon those who are subject to them, but they do not, of necessity, extinguish life, nor even cause disease. It requires more care, however, to preserve life under intense cold than under intense heat. In some parts of India the temperature ranges for a long time together from 80° to 100°, and even 110° of Fahrenheit's thermometer: I believe it sometimes reaches 120°. We can form some estimate of this heat by remembering the oppressive effect of the lowest of these temperatures—that of 80°—to which the thermometer sometimes rises in this country in the hot weather of summer. But these tropical climates are very thickly peopled. In the arctic countries, on the other hand—in the northernmost parts of America, for example, where the sun appears above the horizon for a short part of the year only, and where the thermometer sinks to 40° or 50° below zero—we still find inhabitants indeed, but they are few, and thinly scattered. This mainly depends, no doubt, upon the scanty supply of human food in those parts of the world; but something also is to be ascribed to the depressing influence of extreme cold upon the vital powers. The deficiency of human food is itself owing to the restraining effect of a low temperature upon organic life. Under a degree of temperature a little greater than that at the equator—or a little less than the lowest around the poles—it seems probable that man would soon perish. And in this fact we have one striking instance of the adaptation of external nature to the physical constitution of the human race.

But *for a short time*—and *under certain circumstances*—man is capable of enduring a very much higher degree of heat than the open and general atmosphere ever attains even in the hottest portions of the earth. Whether he could continue to exist, even for a little while, under a much more intense cold than ever occurs naturally on the surface of the globe, is more questionable.

It was long believed that the human body could not be safely exposed, even for a short time, to a degree of heat much exceeding that which is met with in hot climates. This opinion, which we now know to have been erroneous, was strengthened by the result of some experiments made by the celebrated Fahrenheit himself, and related by Boerhaave in his 'Chemistry.' Some animals were shut up in a sugar-baker's stove, where the mercury stood at 146°. A sparrow died in less than seven minutes, a cat in rather more than a quarter of an hour, and a dog in about twenty-eight minutes. The *noxious air* of the stove had probably more to do with the speedy deaths of these animals than the heat. The truth, upon this subject, may be said to have been discovered by accident. In the years 1760 and 1761, MM. Duhamel and Tillet were appointed to devise some means of destroying an insect which consumed the grain in the province of Angoumais, in France. They found that this could be done by subjecting the corn, and the insects contained in it, in an oven, to a degree of heat great enough to kill the insect, but not so great as to hurt the grain. In order to ascertain the precise heat of the oven, they introduced into it a thermometer placed upon the end of a long shovel. The mercury, when the thermometer was withdrawn, was found to indicate a degree of heat considerably above that of boiling water. But M. Tillet was aware that the thermometer had sunk several degrees as it was drawn towards the mouth of the oven. While he was puzzled to invent some way of determining more exactly the actual degree of heat, a girl, who was one of the attendants on the oven, offered to go in, and to mark with a pencil the height at which the mercury stood. And she did enter the oven, and remained there two or three minutes, and then marked the thermometer at 100° of Reaumur, which nearly equal 260° of Fahrenheit. M. Tillet then began to express some anxiety for the safety of the girl, but she assured him that she felt no inconvenience, and stayed in the oven ten minutes longer, during which time the mercury reached the 288th degree of Fahrenheit's scale—denoting 76° of heat above that of water when it boils. When she came out her complexion was considerably heightened, but her respiration was by no means quick or laborious. This experiment was afterwards repeated. Another girl remained in the oven as long as the former had done, at the same temperature, and with the same impunity. Nay, she even breathed, for the space of five minutes, air heated to about 325° of Fahrenheit—or 113° above that of boiling water.

The publication of these facts naturally excited the curiosity of scientific men, and other experiments were soon instituted. Dr. Dobson, of Liverpool, and several other persons with him, shut themselves up in the sweating room of the public hospital there, the air having been heated till the quicksilver stood at 224° of Fahrenheit. They did not experience any oppressive or painful sensation of heat. Dr. Fordyce and Dr. Blagden made some remarkable trials of the same kind. They entered rooms artificially heated to a very high degree, sometimes naked, and sometimes with their clothes on, and bore the extraordinary temperature of 240°, and even 260°, for a considerable time, with very little inconvenience. In all these experiments it was found that the animal heat as ascertained by thermometers placed under the tongue, or grasped in the hand, was scarcely increased at all; and the respiration but little affected: but the pulse was very much quickened. The frequency of Dr. Blagden's pulse in one instance was doubled. You may read a detailed account of these experiments in the 'Philosophical Transactions;' but to give you a more lively notion of the degree of heat to which the bodies of these gentlemen were exposed, I may tell you that their watch-chains, and other pieces of metal about them, became so hot that they could scarcely be touched; when they breathed upon the thermometer, the mercury immediately *sank* several degrees; each act of expiration produced a pleasant feeling of coolness in the nostrils, and they cooled their fingers by breathing upon them. In and by the same heated air which they respired, eggs were roasted quite hard in twenty minutes, and beef-steaks were dressed in thirty-three minutes; and when the air was blown upon the meat by means of bellows, it was sufficiently cooked in thirteen minutes.

It is ascertained then, beyond all doubt, that the human body is capable of sustaining these very high degrees of temperature, *for a short time*, without detriment.

Facts of this kind may, perhaps, appear to you rather curious than useful. Man is never submitted to any natural heat of the air even approaching towards that to which the authors of the experiments I have been describing voluntarily exposed themselves. But a knowledge of extreme cases always tends to throw light upon those that lie *between* the extremes; and the direct results arrived at in these philosophic enquiries are not barren of practical utility to members of our profession. It is not long ago that a man was found almost dead in an oven: he expired a quarter of an hour after he was taken to one of the Borough hospitals, and an inquest was held upon his body. The newspaper report of the case (which is the only one I have seen) states the temperature of the oven to have been about 120°—a candle was melted by it in half a minute. Now, prior to the trials just mentioned, exposure to such a degree of heat would have been held a sufficient cause of death. We now know (and it would be discreditable if we could not support our opinion in a court of law, or before a coroner, by a reference to authentic facts) that something else must have concurred in extinguishing life: and, in fact, it turned out that the man was *drunk* when he went into the oven.

Moreover, there are certain occupations which often oblige those engaged in them to remain for some time exposed to an extremely high temperature; and what has been observed of such persons is that during the exposure they very rapidly lose weight, and as it were melt away. Men employed in keeping up large fires in iron-foundries, and in gas-works, have been found to lose, upon an average, 3 lbs. 6 oz. *avoirdupois* in forty-five minutes. Since these lectures were first delivered, we have had familiar proof, in the common use of the Turkish Bath, that a very high temperature may be borne for a short time, not only without injury, but with comfort and even with advantage. The heat of the rooms of the Bath in Jermyn Street ranges, I am told, from 130° to upwards of 200°.

The immunity from harm to those who are subject to, or who court, a temperature so excessively high, is briefly and clearly explained by Professor Huxley. It depends upon the free perspiration that takes place from the skin, and the moist condition of the mucous membrane of the air passages. The evaporation of this moisture 'checks a rise in the temperature of the superficial blood. The heat of the air is expended in converting the superabundant perspiration into vapour, and the temperature of the man's blood is hardly raised.'

In my opinion, the Turkish Bath is scarcely a safe luxury for persons who perspire with difficulty.

But what are the effects upon the human frame, of a high, yet less excessive, temperature of the air?

One very constant effect of heat is that of stimulating the *organic functions* of the body. We have seen that the temporary application of great heat accelerates remarkably the action of the heart: the pulse was uniformly found to be much increased in frequency in the persons who made trials of their powers of endurance in heated rooms. We have evidence to the same purpose in the annual changes that take place in the vegetable kingdom at a given place, the summer renewing its foliage, the winter checking and repressing it; and still more in the superior luxuriance of vegetation in warm climates as compared with cold. And the same observation applies to those functions which animals possess in common with plants. Towards the poles both man and the lower animals are smaller than at the equator. Linnæus remarks that the hares, partridges, and other animals which inhabit the northern climes, are considerably smaller in size than the same species in more southern countries. And Mr. Tooke, in his 'View of Russia,' observes, 'As we approach nearer to the north pole, both the animal and vegetable productions of nature become more and more stunted. The ordinary stature of the Samoyedes seldom exceeds four or five feet, and their whole exterior corresponds with their dwarfish size.' The stature of the native inhabitants of hot climates does not, I believe, exceed that which is proper to the temperate zone; but if, as is generally supposed, the human body, like plants and fruits, grows faster, and ripens sooner, in proportion as we approach the equator, this must be attributed to the stimulus of heat acting upon the organic life.

On the other hand, and in some sort as a contrast with this, we may observe that considerable heat, when applied for some time together, has a sedative or depressing influence upon the *animal functions*, i.e., upon the nervous system; causing languor and lassitude, want of energy, a disinclination to exertion both bodily and mental.

Under favourable circumstances, and where due precaution is exercised, it is probable that a very high degree of natural temperature of the atmosphere may be borne with impunity. Sir James M'Grigor informs us (in his account of the passage of the army in 1801 from India to Egypt), that during the march over the sandy desert of Thebes, where the heat was *uniform*, though the thermometer in the soldiers' tents was as high as 118°, the health of the troops was equal to that which they had enjoyed in any former period in India.

But there are some forms of disease which are distinctly traceable to heat as their cause.

The effect of hot weather in promoting the cutaneous perspiration is notorious. By the same influence the hepatic function is rendered more active. Dr. James Johnson first, I think, distinctly pointed out the sympathy or consent that obtains between the liver and the skin, under varying conditions of external warmth. Whatever may be the explanation of the fact, experience has taught us that a high atmospheric temperature, when its operation is continued for some time, has a marked influence upon the liver, increasing the quantity of bile that is secreted, and altering its sensible qualities; and this disturbance of function is not unfrequently followed by inflammation of the gland itself. In this country we witness, almost annually, the effects of a course of sultry weather, in those attacks of vomiting and diarrhœa which are so common towards the latter end of summer, and in the autumn, especially when the season happens to have been unusually hot; and which result, apparently, from the excessive quantity, or a morbid state, of the bile. The English cholera (a totally different disorder from that which has of late years been called, most improperly, *the* cholera) is, as you know, so frequent and general in some years, as to be fairly considered and termed an epidemic disease. In tropical climates the same morbific operation of external heat is still more conspicuous; leading not only to violent disorder of the stomach and intestines, with the evacuation of large quantities of vitiated and acrid bile, but also to acute inflammation of the liver going on to suppuration, and the formation of large abscesses. These last diseased conditions are extremely rare in this latitude. The yellow complexions of those who return to England after a long residence in India, are to be attributed to that disordered state of the liver, and of its functions, to which such persons are proverbially subject, and which has in them been brought on by the influence of a hot atmosphere, operating for a long space of time together. Hepatic affections, acute or chronic, are among the chief diseases to which Europeans, at least, are liable in that climate.

We have here an example of the distinction I wish you to notice between predisposing and exciting causes. The heated atmosphere stimulates unduly the secreting function of the liver. Now a secreting organ is never so apt to be affected by any exciting cause of inflammation as when the process of secretion is going on. This law, which I mention by anticipation, depends, no doubt, upon the increased afflux of blood that accompanies the act of secretion. The excessive activity of the hepatic function constitutes thus a predisposition to inflammation of the liver. The hot atmosphere, which creates this predisposition, holds the place of a predisposing cause in respect of the inflammation that ensues: but the exciting cause is exposure to cold; one of the most common and best ascertained exciting causes of inflammation in general. You are not to imagine that there can be no such thing as exposure to cold in a climate where the average temperature of the air is above 80°. Dr. James Johnson, in his book 'On Tropical Climates,' observes that on the coast of Coromandel the temperature is steady by day, and the nights are hot; but yet, he says, nothing is more common than *exposure to cold* in this place. The European soldier or sailor, after the heat occasioned by his employments in the day, strips off his clothes, and lies opposite a window or port, his shirt wet with perspiration, to enjoy the sea breeze at night. And the same author tells us that the application of cold after or during perspiration, commonly produces an attack of hepatitis in some one of its various forms. Now the effect of that kind of exposure here described does not depend upon the *actual* temperature, but upon the *sensation* that is produced, and the sensation depends upon the *relative* temperature; and there can be no doubt that, under the circumstances mentioned by Dr. Johnson, a strong sensation of cold would be occasioned, even by a sea breeze as warm as 80°, or warmer. Changes of temperature seem to be as readily felt at one part of the thermometric scale, as at another, and in whichever direction they take place. Dr. Walsh states, that while sailing along the coast of Brazil, after having been long accustomed to a temperature of 72°, a strong breeze set in from the sea, and the thermometer fell to 61°; (i. e. to a point which we should here call temperate); 'but,' he says, 'the sense of cold from the sudden transition of temperature was quite painful. After bearing it for some time shivering on deck, it became intolerable, and we all went below, put on warm clothing, and dreadnoughts—and again appeared with thick woollen jackets and trowsers, as if we had been entering Baffin's Bay, and not a harbour under one of the tropics.'

It is interesting to compare this statement with Capt. Parry's account of a change of temperature at the opposite extreme of the scale, and in the other direction. Having previously said that the thermometer had fallen to 13° below zero in the night of the 21st of October, he goes on thus—'The wind veering to the south-east on the 24th and 25th, the thermometer gradually rose to 23°. I may possibly incur the charge of affectation in stating that this temperature was much too high to be agreeable to us; but it was nevertheless the fact, that everybody felt and complained of the change. We had often before remarked that considerable alterations of the temperature of the atmosphere are as sensibly felt by the human frame at a very low part of the scale as in the higher. The difference consists only in this, that a change from −40° upwards to about zero is usually a very welcome one; while from zero upwards to the freezing-point, as in the instance just alluded to, it becomes, to persons in our situation, rather an inconvenience than otherwise.'

Besides the more gradual effects of great heat, direct or indirect, upon the human body, it sometimes operates distinctly as an *exciting* cause, and gives rise to more sudden attacks of illness. Persons who are exposed to the direct beams of a hot sun, or for long to a very high atmospheric temperature, especially during any labour or active exercise, are apt to be affected by what is called the sun-stroke, the *coup de soleil*, insolation: they fall down insensible, their breathing becomes laborious, there is extreme prostration of strength, and they often die in a very short time. This disorder is common among troops in long marches in India. It is a complaint of which the cause has long been known by the inhabitants of hot climates. There is a case of it related in the Bible. 'And Manasses was her husband, of her tribe and kindred, who died in the barley harvest. For as he stood overseeing them, and bound sheaves in the field, *the heat came upon his head, and he fell on his bed, and died* in the city of Bethulia.'

Great heat tends also to the production of certain cutaneous diseases: it is said that few Europeans, on their first settling in tropical climates, escape an eruption of pimples, attended with almost intolerable itching and pricking, and lasting for some weeks. It is called in India *the prickly heat.* One of my patients told me that during a six years' residence in Brazil he was never free from this small plague, except when he was suffering for a short time under an attack of jaundice. The prickly heat left him on his voyage home, the affected skin peeling off. He said it was notorious there that in new comers the eruption is protective against other disorders. So that one man will compliment another upon having it, 'I see you are well covered.' When chronic, and let alone, it ceases to be very tormenting.

Before considering that most prolific source of disease which is familiar to the commonest observation in sudden *transitions* of temperature, let us enquire what are the ascertained effects of extreme *cold* upon the human frame. Of course I use the term cold in its popular acceptation, as if it were something positive, instead of signifying the mere privation of heat. It is much more convenient to speak of it in this way, and there is no risk of your being misled by my doing so.

Now this enquiry is of more practical interest to us than that which is concerned with the immediate effects of extreme heat. Even in this climate medical men are not unfrequently called upon, in cases of injury or death produced by intense cold, either to remedy the morbid conditions it has caused, or to explain the mode and probability of its operation in extinguishing life.

The effects of cold, as might well be imagined, are in many respects the direct opposites of the effects of heat. When its application is continued, it acts as a sedative upon the organic functions both of animals and of plants. This appears from the shrinking of the external parts. The superficial arteries become unable to transmit the blood in the usual quantity through the integuments. Hence the skin becomes pale, and contracting round the sebaceous glands and the hair-bulbs, exhibits a roughness which is compared to that of the skin of a plucked goose, and is technically called *cutis anserina.* By the same contraction of the smaller vessels, and repressed circulation, the extreme and projecting parts are diminished in size. Thus, rings which are tight on the fingers while the body is warm, drop off in cold weather—and even the shoes fall from the feet during extreme exposure. The heart with the whole arterial system becomes weak. I have already, when speaking of the contrasted operation of heat, illustrated the withering influence of a continued low atmospheric temperature upon the organic functions, by referring to the dwarfish size of both men and the lower animals, as well as of plants, in cold regions. We have evidence of the same fact in the tardy development of the functions, and particularly, as many travellers affirm, of the sexual functions, in cold climates as compared with hot; and in the winter torpor of certain animals, which is very analogous to the state of trees and shrubs in that season.

I need not tell you that to judge of the effects of mere coldness of the atmosphere we must take the case of the atmosphere *at rest.* The air is a bad conductor of heat, and for that reason, a much lower, as well as a much higher degree of temperature can be borne when it is in a state of quiescence, than when fresh portions of it are perpetually brought into contact with the surface of the body by currents of air. 'With the thermometer,' says Captain Parry, 'at −55°,' (a most fearful degree of cold you will observe, 55° below zero, i. e. 87° below the freezing point), 'with the thermometer at −55°, and no wind stirring, the hands may remain uncovered for ten minutes or a quarter of an hour without inconvenience; while with a fresh breeze, and the thermometer nearly as high as zero, few people can keep them exposed so long without considerable pain.' And speaking in another place of the cold, when the thermometer was 49° below zero; 9° or 10°, that is, below the point at which mercury freezes; he says, 'The weather being quite calm, we walked on shore for an hour without inconvenience, the *sensation* of cold depending much more on the degree of wind at the time, than on the absolute temperature of the atmosphere as indicated by the thermometer. In several of the accounts given of those countries, in which an intense degree of natural cold is experienced, some effects are attributed to it which certainly did not come under *our* observation in the course of this winter. The first of these is the dreadful sensation *said to be produced in the lungs*, causing them to feel as if torn asunder when the air is inhaled at a very low temperature. No such sensation was ever experienced by us, though in going from the cabin into the open air, and *vice versâ*, we were constantly in the habit, for some months, of undergoing a change of from 80° to 100°, and in several instances 120° of temperature, in less than one minute: and what is still more extraordinary, not a single inflammatory complaint (beyond a slight cold, which was cured by common care in a day or two) occurred during this particular period.'

But when the cold air is in motion, in other words, when there is wind, so that fresh portions of cold air are brought, successively in contact with the surface; or when it is accompanied with moisture, or occurs under other circumstances favourable to its operation, and to be spoken of more particularly presently; then cold of a much inferior degree of intensity may very speedily occasion partial or total death. By partial death I mean the loss of vitality in certain parts of the body only—the ears, nose, fingers, toes, and feet. The parts thus affected are said to be frost-bitten: and the mode of managing such accidents falling within the province of surgery, I shall confine my remarks almost entirely to the case where general death—death in its full and ordinary meaning—is either brought about, or impending, in consequence of exposure to cold.

One of the earliest effects of extreme cold upon the system at large has been said to be a remarkable and overpowering drowsiness. But I believe you will find that most or all of the persons in whom this torpor has been noticed had not only been exposed to severe cold, but had been using also a great deal of exercise: and perhaps the drowsiness ought to be ascribed, in some measure at least, to that exercise. They who attribute it to the cold alone, explain the comatose state in this way. They say that the chilling of the surface and extremities drives the blood inwards, causes it to accumulate internally, and increases the flow of blood towards the head. One thing, however, is certain, viz., that drowsiness is not a necessary consequence of exposure to severe cold, although it is a very common consequence. Dr. Currie, in his 'Medical Reports,' gives a very interesting account of the shipwreck of an American vessel on the coast of Ireland. Most of the crew, fourteen in all, were immersed to a considerable depth, for twenty-three hours, in water of which the temperature was believed not to exceed 33° or 34° of Fahrenheit: and he states expressly that none of the men were drowsy, and that in no one of the three who perished was death preceded by sleep.

The overpowering tendency of cold when combined with fatigue (and perhaps under certain circumstances of intense cold alone), to induce sleep, was strikingly exemplified in what befell Dr. Solander among the hills of Terra del Fuego. The story, as given in Captain Cook's 'Voyages,' is well known. Sir Joseph Banks and Dr. Solander had been out botanising. On their return towards the ship, after various hardships, and after having travelled through swamps for a considerable way, the weather, which had been very fine, became gloomy and cold, with sudden blasts of piercing wind, accompanied by snow. Finding it impossible to get back to the ship before the morning, they resolved to push on through another swamp that lay in their way, into the shelter of a wood, where they might build a wigwam and kindle a fire. Mr. Banks (as he was then) undertook to bring up the rear. Dr. Solander, who had more than once crossed the mountains that divide Sweden from Norway, and who well knew that extreme cold, especially when joined with fatigue, produces a torpor and sleepiness which are almost irresistible, conjured the company to keep moving, whatever pain it might cost them, and whatever relief they might be promised by an inclination to rest. 'Whoever *sits down*,' said he, 'will *sleep*, and whoever *sleeps*, will *wake no more*.' Thus at once admonished and alarmed, they set forwards; but they had not gone far before the cold became suddenly so intense as to produce the effects that had been most dreaded. Dr. Solander was the *first* who found the inclination, against which he had warned others, invincible, and he insisted on being suffered to lie down. Mr. Banks entreated and remonstrated with him in vain: down he lay upon the ground, although it was covered with snow, and it was with much difficulty that his friend kept him from sleeping. Richmond also, one of the black servants, began to linger in the same manner. When he was told that if he did not go on he would in a short time be frozen to death, his answer was that he desired nothing but to lie down and die. The Doctor said he was willing to go on, but that he must first take some sleep; although but a short time before he had told the company that to sleep was to perish. Mr. Banks and the rest found it impossible to carry them, and there being no remedy, they were both at length suffered to lie down, being partly supported by some bushes; and in a few minutes they fell into a profound sleep. Soon after some of the people who had been sent forward returned with the welcome news, that a fire was kindled about a quarter of a mile on the way. Mr. Banks then endeavoured to wake Dr. Solander, and happily succeeded; but though he had not slept five minutes, he had almost lost the use of his limbs, and the flesh was so shrunk that his shoes fell from his feet. He consented to go forward with such assistance as could be given him; but no attempts to relieve poor Richmond were successful. He, together with another black left with him, died.

In many instances, before this complete torpor comes on, intense cold has a curious effect upon the nervous system, blunting the sensations, and confusing the intellect, and giving to the person exposed to it the appearance of one intoxicated. It is very necessary that you should be aware of this, for there is too much reason to believe that poor wretches who have been picked up by the constables in the streets at night, during periods of hard frost, have been supposed to be drunk, when, in truth, they were only stupefied by the cold. Such a mistake is most likely to be fatal to them. Instead of receiving the attention and treatment proper for persons in their condition, they are liable to be laid aside, by themselves, to sleep off their supposed debauch; and the morning finds them corpses. It is not at all improbable that some of you may be called upon to investigate such cases: and as actual instances are more readily impressed upon the memory than any general description, I will read you a short history illustrative of what I have just been saying, from Captain Parry's Journal.

'John Pearson*** had his hands severely frost-bitten, having unfortunately gone without mittens, and with a musket in his hand. A party of our people, most providentially, found him, although the night was very dark, just as he had fallen down a steep bank of snow, and was beginning to feel that degree of torpor and drowsiness which, if indulged, inevitably proves fatal. When he was brought on board his fingers were quite stiff, and bent into the shape of that part of the musket which he had been carrying; and the frost had so far destroyed the animation in his fingers on one hand, that it was necessary to amputate three of them a short time after.'

It is what immediately follows this, that I was desirous of pointing out to your attention.

'The effect which exposure to severe frost has in benumbing the mental as well as the corporeal faculties, was very striking in this man, as well as in two of the young gentlemen who returned after dark, and of whom we were anxious to make enquiries respecting Pearson. When I sent for them into my cabin, they looked wild, and spoke thick and indistinctly, and it was impossible to draw from them a rational answer to any of our questions. After being on board for a short time, the mental faculties appeared gradually to return with the returning circulation; and it was not till then that a looker-on could easily persuade himself that they had not been drinking too freely. To those who have been much accustomed to cold countries, this will be no new remark, but I cannot help thinking (and it is with this view that I speak of it) that many a man may have been punished for intoxication, who was only suffering from the benumbing effects of frost: for I have more than once seen our people in a state so exactly resembling that of the most stupid intoxication, that I should certainly have charged them with that offence, had I not been quite sure that no possible means were afforded them on Melville Island to procure anything stronger than snow-water.'

Facts of a precisely similar kind are narrated in the late Dr. Kane's very interesting account of his 'Arctic Explorations in 1853, 54, and 55.'

When persons in this state are suffered to sleep, and the operation of the cold continues, they become less and less sensible to external impressions, until death closes the scene.

Strictly in accordance with the foregoing statements are the results observed by Dr. Richardson, of diminishing, in birds, the temperature of the brain, even to the degree of congelation, by means of the æther spray. As the cold deepens, the pigeon subjected to it becomes dull, unsteady, and at length drops down insensible and apparently dead. And it is a most curious and interesting fact that when the frozen nervous pulp is allowed slowly to thaw, the bird gradually revives, and in a short time seems to be perfectly unharmed by the strange process it has undergone.

LECTURE VII.

Causes of Disease, continued. Laws by which the operation of Cold upon the Bodily Health is regulated. Circumstances that favour its injurious Effects, and respect, first, the Body itself; secondly, the manner in which the Cold is applied. Modifying influence of certain states of the Mind—of Sleep—of Habit. Means of protection. Influence of the different Seasons. Impurity of the Air. Hereditary tendencies to Disease.

In the last lecture I commenced the consideration of some of the *causes* of disease.

We learned, by the evidence of authentic facts, that the human body is capable of bearing a very *high* degree of external temperature, for a short time, without detriment—and even without much inconvenience; and we learned—also by the testimony of facts—that the body is equally well calculated to endure, under favourable circumstances, a very *low* degree of atmospheric temperature—or, to speak in popular language, a very intense degree of *cold*.

It appears also that a high, but not extreme, atmospheric temperature, when long continued, has a stimulating effect upon the *organic* functions, and a depressing or sedative effect upon the *animal* functions of the body. Long-continued heat predisposes the body to be injuriously influenced by exposure to cold: the diseases apt to follow such exposure, under such circumstances, being derangement of the hepatic functions—violent disturbances of the stomach and bowels, with a copious discharge of vitiated and acrid bile—and acute inflammation of the liver itself. As more direct consequences of exposure to extreme heat—in other words, as examples of disorders of which extreme heat sometimes proves an *exciting* cause—I mentioned the *coup de soleil*, and the eruption called the *prickly heat*.

With respect to external cold, I pointed out to you its depressing effects upon the organic functions of the body—and, when it becomes very intense indeed, its directly sedative influence upon the animal functions also—producing a state resembling intoxication, overpowering drowsiness, and coma, especially when the cold has had an auxiliary in fatigue; and, ultimately, death itself.

I hardly need say that the effect of external cold upon the body within certain limits of intensity and duration, is totally different from all this. When it is not intense—or when, though intense, it is applied for a short time only—or when its refrigerating and sedative properties can be sufficiently counteracted by exercise and warm clothing—cold becomes a *tonic*; stimulating, refreshing, and invigorating both mind and body. Instead of benumbing, it heightens the sensibility; instead of stupefying, it clears and sharpens the faculties, and bestows alacrity and cheerfulness of spirit; and in this way, among others, cold becomes a very important curative agent.

Here also, therefore, the contrast obtains; a high external temperature relaxes and depresses—a low one, under the circumstances just mentioned, braces and enlivens.

Nevertheless, exposure to cold is one of the most common causes of various complaints. Many or most of the internal inflammations acknowledge cold as their ordinary exciting cause. Acute rheumatism has, perhaps, no other external origin. Apoplexy, and palsy, and dropsy, are its frequent consequences. 'With the exception,' says Dr. Bateman, in his 'Observations on the Diseases of London,' 'with the exception of a small number of diseases occasioned by unwholesome occupations, and by the contagions, the great mass of human malady in this metropolis is referable to the climate or state of the seasons, and to intemperance; but, of these two causes, the vicissitudes of the weather, especially its cold, are by far the most prolific sources of mischief.'

It must, therefore, to every one who is engaged, or likely to be engaged, in the practice of physic, be a matter of first-rate importance, and of great interest, to ascertain the circumstances under which the application of cold is the most prejudicial, or has the greatest influence upon the body—as well as the means by which the bad effects of exposure to cold may often, in a great degree, be prevented.

There are some short but valuable hints upon this subject in Cullen's 'First Lines.' The late Dr. Currie, of Liverpool, was, however, the first person who distinctly pointed out the laws that regulate the operation of cold as a cause of health and disease.

Of the circumstances which favour the morbific effects of cold, some relate to the condition of the body itself, some to the particular manner in which the cold is applied. The former are predisposing circumstances; the latter accessory. We will glance at these in succession.

It has long been a popular, as well as a professional axiom, that *sudden vicissitudes* of temperature are dangerous; that a *previous hot state of the body* augments the hurtful effect of cold, whether applied externally or internally. But the proposition thus broadly stated is not universally true. It is well known that the inhabitants of Russia are in the habit, while reeking from their vapour baths, of rolling immediately in the snow, or plunging into cold water, without suffering from the change. So a cold shower bath following instantly upon a hot douche has been described to me, by those who have tried it, as a great and wholesome luxury. The same pleasant contrast is indulged in by many of the frequenters of the Turkish Bath. Sir Charles Blagden, reporting some of the experiments which I mentioned in the last lecture, says, 'During the whole day we passed out of the heated room (of which the temperature ranged from 240° to 260°) after every experiment, immediately into the cold air without any precaution. After exposing our naked bodies to the heat, and sweating most violently, we instantly went into a cold room, and stayed there even some minutes before we began to dress, yet no one received the least injury.' And Captain Scoresby, speaking of the arctic regions, tells us that he has often gone from the breakfast-room of the vessel, where the temperature was 50° or 60°, to the mast-head, where it was only 10°, without any additional clothing, except a cap—'yet,' says he, 'I never received any injury, and seldom much inconvenience, from the uncommon transition.'

It is plain, therefore, that the proposition which assigns danger to sudden vicissitudes of temperature requires limitation. The effects of a sudden descent from one point to another in the scale of atmospheric temperature vary according to the state of the body at the time. Without going into any physiological discussion respecting the source of animal heat, I may just remind you of the faculty of evolving heat possessed by man and the warm-blooded animals; by which faculty very nearly the same degree of inward temperature is steadily maintained under very different degrees of outward temperature. If the external temperature be lower than that of the body, the heat thereby carried off is speedily replaced, in a healthy adult, by this evolution of heat from within, aided by clothing, or by exercise. When the external temperature approaches the standard heat of the body, sweat soon breaks forth, and the superfluous heat is removed by evaporation: for so constant is the internal evolution of heat, that an atmosphere which does not as constantly abstract any of it is excessively incommoding. An external temperature of 98°, which is about the average heat of the blood in man, is, as you know, extremely oppressive. The terms hot, warm, cool, cold, as applied to the surrounding air, are regulated by the sensations that it impresses upon the average of persons. If the heat be carried off as fast as it is generated, and no faster, no particular sensation is felt, and the bodily powers are neither stimulated nor exhausted. This equilibrium is maintained (supposing that no extraordinary exertions are made) when the thermometer stands at 62°, or thereabouts. We call that point in the scale *temperate.* All degrees above that point, up to 70, are reckoned *warm*; all above 70, *hot.* Descending in the scale, we speak of the temperature denoted by any degree between the 60th and the 50th as being *cool*; and every lower degree of temperature is *cold.* I am speaking of the average of healthy men: for remarkable diversities occur among individuals in respect of the epithets which they assign, under the guidance of their sensations, to particular degrees of the thermometric scale; their sensations differing according to the power which their constitutions respectively possess of evolving heat. Now if this power of evolving heat, thus inherent in the system, be entire, and active, and persistent—if it have not been weakened by any of those circumstances which are known to have the effect of weakening it—no peril need attend even violent alternations of external temperature. Unusual heat of the body at the time when the cold is applied, so far from implying danger, is really the condition of safety, provided the heat is steady and permanent. You may read, in Dr. Currie's book, numerous instances of the cold affusion being employed in the hot stage of fever, and particularly in cases of scarlet fever, not only with impunity, but with great apparent benefit to the patient. The same holds true of the application of cold when the body has been heated by exercise—and, indeed, whatever may have been the cause of the increased heat—always on condition that this cause remains steadily in action, that there is no local disease, and that the body is not fatigued, and fast losing its heat. But if a person be already exhausted and weakened by exercise—if he be sweating and rapidly parting with his heat—and especially if the exercise be over, and he remain at rest immediately after and during the application of the cold—then it becomes highly perilous, and likely to produce internal mischief.

The more correct statement, therefore, respecting the application of cold is, that it is dangerous—not when the body is *hot*—but when the body is *cooling after having been fatigued and heated.*

This principle obtains alike, I say, whether the cold be applied externally or internally; to the surface of the body, or to the mucous membrane of the stomach. Very many instances are recorded of death taking place immediately after a copious draught of cold water. I believe it will be found that in all these cases, the body, after having been much heated and enfeebled by severe exertion, was losing its preternatural heat from profuse perspiration, and, in general, from the cessation also of the exertion by which this heat had been accumulated. Celsus was aware of the danger: 'ex labore sudanti frigida potio perniciosissima est.' The fatal influence of cold water thus applied was experienced, on a large scale, among the troops of Alexander the Great, upon their reaching the banks of the River Oxus, thirsty, fatigued, and perspiring from their toilsome march of forty-six miles across the scorching sands of the desert. According to Quintus Curtius, Alexander lost more of his soldiers on that occasion than in any one of his battles. 'Sed qui intemperantius hauserant intercluso spiritu extincti sunt; multoque major horum numerus fuit, quam ullo amiserat prœlio.' Dr. Currie relates a striking example, which fell under his own observation, of sudden death thus produced. A young man had been playing a severe match at fives, and had violently heated himself. When it was over he sat down on the ground panting for breath, and covered with profuse perspiration. In this state he called to a servant to bring him a pitcher of cold water just drawn from a neighbouring pump. After holding it in his hand a little while, till he recovered his breath, he put it to his mouth, and drank a large quantity at once. He laid his head on his shoulder, and bent forwards; his countenance became pale, his breath laborious, and in a few minutes he expired.

I may take the opportunity of telling you that the remedies to be administered, when life is in jeopardy from this cause, are heat to the epigastrium, and laudanum in free doses.

If death do not speedily follow the external or internal application of cold to the body under the untoward circumstances I have described, inflammation of some internal part is very apt to arise.

By attending to the principles now laid down, you will be enabled to furnish those whom it may be your business to advise with many useful suggestions, and to caution them against common mistakes: mistakes which have had their origin in the unqualified credit given to the maxim, that sudden vicissitudes of external temperature, and exposure to cold while the body is hot, are dangerous; whereas, these things are dangerous under certain circumstances only. Thus, you may tell the sportsman that wet feet, or a wet skin, need cause him no apprehension, so that he continues in active exercise; and changes his clothes, and avoids all further application of cold, as soon as his exercise ends. You may admonish the bather that after walking on a hot day to the river's side, he had better *not* wait, to cool himself a little, before he plunges into the stream; and in like manner you may venture to counsel the young lady who has heated herself with dancing, not to linger in the entrance-hall till the glow has somewhat subsided, but to make the best of her way to her carriage, and thence to her bed; and you may tell your male friends who happen to be similarly circumstanced, that the best thing they can do is to walk briskly home in their great coats. The main points to be remembered are, that 'the heat which is preternaturally accumulated by exercise is held with little tenacity, is dissipated by profuse perspiration, and is speedily lost when to this perspiration is added a state of rest after fatigue;' and that, in these circumstances, the application of cold is most apt to be prejudicial.

Among the circumstances which favour the morbific effects of cold, and relate to the condition of the body itself, is to be included—for reasons that must now be obvious to you—whatever has the effect of weakening the system, and so diminishing its capability of evolving heat. The most common of these debilitating circumstances are enumerated by Cullen—'fasting, evacuations, fatigue, a last night's debauch, excess in venery, long watching, much study, rest immediately after great exercise, sleep, and preceding disease.' All these, you will observe, tend to lessen the vigour of the circulation, and to depress the power of generating heat. Consistent with the same principle is the fact ascertained by Dr. M. Edwards, that the faculty of evolving heat is very feeble in old persons, and in the newly born; it being in these classes that we find the greatest number of victims to the power of cold.

The bad effects of cold upon the system depend partly upon the intensity of the sensation it produces—but still more upon the duration of that sensation. We are seldom the worse for a momentary sensation of cold, however lively it may have been; whereas even slight feelings of chilliness, if long protracted, are apt to terminate in some form of disease.

By the help of this principle we may explain most of the circumstances which, relating to the manner in which the cold is applied, have been found by experience to aggravate its hurtful influence.

Cold is more likely, *cœteris paribus*, to prove injurious when it is applied by a wind or a current of air. The sensation of cold is sustained by the continual accession of fresh particles of frigid air to the surface of the body. Some striking facts in illustration of the refrigerating and depressing effects of a stream of cold air were mentioned in the last lecture.

Again, the injurious operation of cold is augmented, when it is accompanied with moisture. Wetness is notoriously the worst way in which cold can be applied. The contact of wet or damp clothes with the skin both increases and prolongs the sensation of cold. For the same reason, a cold foggy atmosphere is more prejudicial than a clear, and therefore drier one, of the same temperature. The heat of the body is abstracted more rapidly than it is generated from within, and if it be not replaced by exercise, or cordials, the balance of the circulation is deranged, and internal mischief often follows.

The same principles serve to illustrate the effect of certain other circumstances, adverted to by Cullen, as being *counteractive* of the morbific tendency of exposure to cold: 'passions engaging a close attention to one object;' 'that state of the body in which sensibility is greatly diminished, as in maniacs;' and 'the power of habit.' These circumstances are worthy of a moment's notice.

Impressions which are unheeded are unfelt and inoperative. As it is scarcely possible, when the attention is engrossed by bodily pain, to carry on any connected train of thought, so, on the other hand, the senses become impassive in proportion as the mind is fixed upon some absorbing subject of reflection, or enchained by some powerful emotion: impressions made upon the organs of sense are no longer taken notice of; the corresponding sensations, if they be excited at all, are not remembered, and the effect of such impressions is as if they had never been; they are not followed by the usual consequences. Persons gasping for breath in spasmodic asthma will remain for hours at an open window, with scarcely any clothing, during severe frost, and without suffering from the cold; their attention is so anxiously and exclusively bestowed upon the distress in their breathing, that the coldness of the air is unnoticed and unperceived, and has no sensible effect.

> For where the greater malady is fixed,
> The lesser is scarce felt.

The morbific effect of cold upon the system is certainly modified by the degree of attention that is paid to the sensation it excites.

Upon the very same principle may be explained the impunity with which some maniacs undergo exposure to cold—even when suffering no fever which might regenerate the lost heat. 'I have seen,' says Dr. Currie, 'a young woman, once of the greatest delicacy of frame, struck with madness, lie all night on a cold floor, with hardly the covering that decency requires, when the water was frozen on the table by her, and the milk that she was to feed on was a mass of ice.'

Sleep is enumerated by Dr. Cullen among those conditions of the body which diminish its power of resisting cold. And certainly cold is very readily caught (as the phrase is), when its causes are present, during sleep. But while we sleep sensation is in a great measure suspended. This would seem, therefore, to furnish a contradiction to the principle that the effect of cold upon the bodily health depends upon the strength and the duration of the sensation excited by it. Dr. Alison—I speak from recollection of his observations heard many years ago—disposes of this difficulty by affirming that the sleeper who thus suffers, does really feel, and is conscious of, the sensation of cold, and that it mingles with, and probably suggests, his dreams. Lord Brougham, in his 'Discourse of Natural Theology,' gives a very lively picture of dreams so excited, drawn, as I should guess, from his own experience. Probably something of the same kind has occurred to most of us. 'Everyone knows (he says) the effect of a bottle of hot water, applied during sleep to the soles of the feet; you instantly dream of walking over hot mould, or ashes, or a stream of lava, or having your feet burnt by coming too near the fire. But the effect of falling asleep in a stream of cold air, as in an open carriage, varies this experiment in a very interesting, and indeed instructive manner: you will, instantly that the wind begins to blow, dream of being upon some exposed point, and anxious for shelter, but unable to reach it: then you are on the deck of a ship, suffering from the gale—you run behind a sail for shelter, and the wind changes, so that it still blows upon you; you are driven to the cabin, but the ladder is removed, or the door locked. Presently you are on shore in a house with all the windows open, and endeavour to shut them in vain; or, seeing a smith's forge, you are attracted by the fire, and suddenly a hundred bellows play upon it, and extinguish it in an instant, but fill the whole smithy with their blast, till you are as cold as on the road.'

Certain it is, that though while sleeping we are not sensible of, or (what perhaps is the same thing) do not remember, ordinary impressions, we are nevertheless conscious of unusual sensations; so that the facility with which we take cold during sleep is no real exception to the general law, that the sensation produced by cold is concerned in its injurious effects.

The last of the accessory circumstances mentioned by Cullen is 'the power of *habit.*' No one can doubt the effect of custom in enabling the body to resist the operation of cold, who has had opportunities of observing how differently an inclement temperature is borne by persons whose employments oblige them to live much under the open sky, as shepherds, sailors, stage-coachmen, drivers on railways; and by such as pursue in-door occupations—mechanics, tailors, shopmen, and the like. Probably the sensibility of the surface is blunted by habitual exposure. We may believe, too, that the purer air breathed by the out-door labourer, and his more active life, confer a more vigorous state of health, and endow him with an ampler faculty of evolving animal heat. The fact is unquestionable; and we may sometimes turn our knowledge of it to good account, in gradually fortifying the system against the influence of cold that cannot be avoided. An ill-directed application of this principle has led, however, to grave errors, and cost many lives. You will now and then hear parents talk of *hardening* their children, by causing them to brave all sorts of weather, by teaching them to be indifferent about variations of temperature, to sit in winter-time without a fire in the room, and to despise great coats, flannel, and other additions to their usual dress. Fearing to render them effeminate by over care and cockering, they run into the opposite and more dangerous extreme.

This process is often attempted with children originally delicate, and to such it is doubly hazardous. During the early periods of life the inherent protective power of evolving heat is comparatively feeble; and in this climate it requires to be carefully cherished.

The experiment of hardening should never be tried on any child or person who is ailing or unsound; who shows any sign of present disease; or any marked disposition to future, and especially to scrofulous, disease. Whenever it is tried it must be conducted in conformity with the principles already laid down. The subject of the experiment must be sufficiently clothed, and he must not fail to use such exercise during the exposure as may be requisite to excite and sustain the adequate generation of animal heat. An *abiding* sense even of chilliness must never be aimed at, nor permitted.

The most direct and certain mode of fortifying the body against injury from accidental exposure to cold, is afforded by the use of the cold sponge bath, or of the shower bath. When this is regularly taken in the morning, the surface of the body becomes inured to a degree of cold greater than it is likely to encounter during the remainder of the day. It is fortunate that we have an easy criterion of the propriety of continuing this expedient. When the sense of cold does not remain long, and is followed by a glow of warmth, the cold shower bath is sure to do good. If, however, after the bath, the person suffer headache, and continue to be chilly, blue, languid, and uncomfortable, it should at once be given up, as useless, and even hazardous.

By observing these simple rules, a healthy child may be made hardy also, without the risk which their neglect would impose, of damage to his bodily fabric, and of abbreviating, by what was meant to prolong, his mortal span.

Closely connected with the effects of temperature upon the health is the influence of the different *seasons* of the year. A few remarks upon that influence, as it is witnessed in our own climate and country, may properly conclude our present subject.

It is open to the commonest observation that the general health of the community fluctuates with the changing seasons. Catarrhs, and coughs, and pectoral complaints of all kinds, are most apt to commence, or to grow worse, in the winter and spring months; while bowel complaints are more numerous and distressing in the summer and autumn. The mucous membranes of the air-passages sympathise with the skin under the agency of external cold; those of the stomach and intestines under that of continued atmospheric heat.

The thoracic disorders are more serious and fatal than the abdominal. Various other maladies are likewise aggravated by cold, or by vicissitudes of temperature. Hence the mortality of the winter is always larger than that of the summer: unless, indeed, this rule happens to be disturbed by the intervention of some widely-spread epidemic. I am not sure that the superior salubrity of the hotter over the colder portion of the year is generally acknowledged, even in this age of enlightenment.

It is the cold that, more than any other element of the weather, occasions the difference.

There are two small publications by the second Dr. Heberden, to which I would direct your attention, as being singularly instructive upon these points. One you will find in the eighty-sixth volume of the 'Philosophical Transactions:' *Of the influence of Cold upon the Health of the Inhabitants of London.* The other is a separate pamphlet: 'Observations on the Increase and Decrease of different Diseases.'

From a number of tables, framed chiefly upon the weekly bills of mortality, Dr. Heberden (in the last-named paper) draws the conclusion that the whole number of deaths is greatest in January, February, and March, and least in June, July, and August. This is contrary to the notions of the ancients, and perhaps of many of the moderns also. Celsus says, 'Igitur saluberrimum ver est; proxime deinde ab hoc, hiems; periculosior æstas; autumnus longe periculosissimus.'

The difference of place may perhaps account for this difference of opinion. Celsus lived in Rome. That city, and the surrounding district, abound in *malaria*; a cause of disease which, happily, is now scarcely known in London, but which, wherever it exists, operates most powerfully and most extensively during the autumn. The comparative healthiness of the several seasons may doubtless be disturbed, and even reversed, by endemic peculiarities of this kind.

In his paper in the 'Philosophical Transactions,' Dr. Heberden compares the number of deaths that took place in London in January, 1795, which was an unusually severe month, with the number that occurred in January, 1796, which was an uncommonly mild month. Of those two successive winters one was the coldest, and the other the warmest, of which any regular account had been kept in this country. In the month of January, 1795, the thermometer, upon an average, stood at 23° in the morning, and at 29·4° in the afternoon; always, you will observe, below the freezing point. In the same month in

1796, it stood at 43·5° in the morning, and at 50° in the afternoon; always much above the freezing point. The average difference in the two months was more than 20°.

In the five weeks beginning upon January 1st, 1795, there were 2,823 deaths: in the five weeks beginning upon January 1st, 1796, there were only 1,471. The difference, 1,352, is enormous. The mortality in the former year was nearly double that in the latter.

One object which Dr. Heberden had in view in making this comparison, was to disabuse his countrymen of the notion that, in winter, frosty weather is more favourable to health than mild weather; a notion which has been embodied in the proverb, that 'a green Christmas makes a fat churchyard.'

It is very instructive to remark in what class of persons the injurious effects of the severe weather of winter is most felt. The increased mortality was found to be chiefly among the very young, and the very old: in other words, among those in whom the recuperative power of generating heat is the feeblest.

In January, 1795, there were in London 717 deaths of persons above sixty years old, while in January, 1796, there were only 153 such deaths; or scarcely more than one-fifth of the former number.

I have often been struck by the unusual length of the newspaper obituaries during periods of hard frost; and by observing how many of the individuals whose deaths they record were far advanced in years. Dr. Heberden remarks that among persons older than sixty, the tide of mortality, as measured by the weekly bills, follows regularly the degree of coldness of the weather; so that anyone accustomed to examine these lists may form a tolerably accurate judgment of the severity of any of our winter months, by noting the ratio of the mortality in persons above sixty.

The deaths from asthma (under which vague term all kinds of pectoral disorder attended with shortness of breath appear to have been included) were 249 in January, 1795; only 29 in January, 1796. In the former of these months there were 825 deaths attributed to consumption; in the latter, 342.

All this accords with what I mentioned before of the effect of cold weather in producing or exasperating diseases of the respiratory organs.

One of the conclusions deduced by Dr. Heberden from his examination of the bills of mortality is, that 'the number of deaths by palsies and apoplexies is in this country always greatest in winter.' There are intelligible reasons for this. When the surface is chilled, and the blood driven out of the superficial vessels by the cold, it must accumulate in internal parts, and so press with increased force towards the head. And there is another reason for the frequency of these affections in the winter season: it is, as we have seen, the season of pectoral complaints, and of embarrassed respiration. Dyspnœa, and fits of coughing, greatly impede the return of the blood from the head through the veins: and cerebral congestion tends to the production of cerebral hæmorrhage, especially when the arteries of the brain are diseased; and they often are so. Accordingly we find that in January, 1795, there were fifty-two deaths from apoplexy and palsy; while in January, 1796, the number was only thirty-one.

Since the original delivery of these lectures, several *Annual Reports of the Registrar-General of Births, Marriages, and Deaths in England*, have been printed, and liberally circulated, by the obliging attention of Mr. Lister and of Major Graham, among the members of our profession. Much of the practical information afforded by these interesting volumes is rendered accessible, even to a cursory reader, by Dr. Farr's able analysis of the registered facts; which amply illustrate and confirm most of the inferences drawn by Dr. Heberden from the old tables of mortality.

For example, under the head of 'Influence of the Seasons,' Dr. Farr shows, by numerical statements, especially in the *third* Annual Report, that in London the degree to which the mean monthly temperature descends in December, January, or February, determines, to a great extent, the mortality of the winter.

Again, 'The causes of death which prove most fatal in the cold months belong principally to the pulmonary class, and the cerebral diseases of the aged: those which prove most fatal in summer belong to diseases of the bowels.' Perhaps a part of the injurious effect of the summer heat arises from the more rapid escape which it promotes of noxious gases from the sewers.

The mean temperature of the external atmosphere in London is 50½°. In proportion as *the mean temperature of the day and night* falls beneath that point, the mortality progressively increases.

'The rise in the mortality,' says Dr. Farr, 'is immediate; but the effects of the low temperature go on accumulating, and continue to be felt thirty or forty days after the extremities of the cold have passed away. The cold destroys a certain number of persons rapidly; and in others occasions diseases which prove fatal in a month or six weeks. The practical lesson taught by these facts is obvious. A great number of the aged, and of those afflicted with difficulty of breathing, cannot resist cold sunk so low as 32°. The temperature of the atmosphere in which they sleep can never safely descend lower than 40°; for if the cold that freezes water in their chamber do not freeze their blood, it impedes respiration, and life ceases when the blood heat has sunk a few degrees below the standard.'

The immense body of authentic facts thus yearly accumulating in these Reports constitute most valuable contributions to the science of vital statistics; and cannot fail to throw light upon the sources, and to point towards the prevention, of many very dangerous and destructive disorders. To ascertain the causes of any disease, and to display them before the public mind, are, I repeat, large steps towards the ultimate removal of such as human endeavours are competent to remove.

You may trace the influence of the seasons, not only in the prevalence of particular diseases in certain portions of the year, but also in the character of other disorders that are liable to occur in all periods of the year alike: in the character, for example, of fevers. In the majority of cases of continued fever you will find that the pectoral symptoms are most troublesome in the spring, and the abdominal symptoms in the autumn. It is said also, but I do not know that this is so generally true, that affections of the head, in continued fever, are more frequent and severe in the winter than at other periods of the year. These observed differences depend, no doubt, in part upon the greater average frequency of one *species* of continued fever than another at those respective seasons.

Mere impurity of the air—by which I mean impurity that does not result from the admixture of any *specific* poison, such as the marsh poison, and the various contagions—is a powerful predisposing cause of disease. The prejudicial effect of impure air is seen, on a large scale, by comparing the inhabitants of great towns, in respect of health and longevity, with those who live in the country. If we again refer to Dr. Farr's calculations, founded upon the returns made to the Registrar-General, we find it stated, in the third Annual Report, that in cities, as contrasted with rural districts, the deaths from consumption are increased 24 per cent.; those from typhus 55 per cent.; those from childbirth 59 per cent.; and so of several other disorders. 'The diseases chiefly incidental to childhood are twice as fatal in the town districts as they are in the country.' The mean duration of life in the two classes of districts differs by nearly 17 years; being in the proportion of 55 years (*country*) to 38 years (*towns*).

These differences we can explain only by attributing them to the weakening influence of impure air, and the want of sufficient exercise; for, as Dr. Alison has remarked, 'it is hardly possible to observe separately the effect on the animal economy of deficiency of exercise, and deficiency of fresh air, these two causes being very generally applied together. But it is perfectly ascertained on an extensive scale, in regard to the inhabitants of large and crowded cities as compared with the rural population of the same climate, that their mortality is very much greater, especially in early life—and the probability of life very much less.' There is one circumstance which shows that impure air is the more noxious agent of the two, namely, the great comparative mortality, in towns, of children under two years of age, even although they get as much exercise as their time of life would allow of anywhere.

The noxious and depressing influence of vitiated air is made strikingly manifest by the effect of removal to a purer atmosphere. We are continually obliged to recommend 'change of air' to our patients. We advise them to go out of London,—'where houses thick and sewers annoy the air,'—that their recovery from acute disorders may be accelerated, and that they may regain the degree of general strength which is necessary to the cure of many chronic complaints; of all those especially that require the use of *tonic* medicines, among which class of remedies no one is so effectual, in constitutions that have been weakened by a town life, as migration to the clear and pure air of the country.

It is necessary, however, to remember that although impure air has most unquestionably a very hurtful effect upon the general health, there is no specific disease which can be distinctly traced to it as an *exciting* cause. It is as a predisposing influence that the impurity operates. For instance, it never *generates* (as I believe) continued fever, yet it will most certainly aggravate the symptoms, and favour the propagation, and augment the mortality, of that and of other diseases, in a great degree. If there be any diseased condition that is strictly the product of impure air, it is scrofula. Scrofula (as I shall presently show you) depends in part upon hereditary constitution: it partly arises also from exposure to cold and wet; but there is much reason for believing that impure air is a very powerful agent in calling scrofula into action, and in aggravating the strumous diathesis.

I have entered the more fully into the consideration of certain states of the atmosphere, its extremes and its variations of temperature, and its impurity, as causes of disease, because there is no part of the course in which I could more conveniently introduce them. Most of the other causes of disease, enumerated in my last lecture, will be discussed in connection with the disorders to which they give birth: malaria, for example, when I speak of ague; contagions, when we come to the exanthemata and to continued fevers; epidemic influences, with epidemic distempers; improper or insufficient diet, and intemperance generally, with indigestion, and the disorders of the alimentary canal; and so on. There is, however, one remarkable predisposing cause of disease, a few observations upon which may serve to fill up the little that remains of the present hour. I mean, that disposition to certain diseases which is apt to descend from parents to children: *hereditary tendency* to disease.

We must distinguish between *susceptibility* of disease, and a *tendency* to disease. In one sense all persons are born with a predisposition to most forms of disorder. No one is protected by nature against inflammation when the causes of inflammation come into play. Poisons of various kinds, and specific contagions, which indeed are poisons, operate with tolerable uniformity upon *all men* alike.

But there are certain complaints which we may separate in this respect from the others: which complaints some persons have a tendency to, and some have not. The tendency is sometimes strong and evident, sometimes feeble and faintly marked; sometimes it displays itself in the midst of circumstances the most favourable to health, sometimes it requires for its development conditions the most adverse and trying. To mention some of these diseases: scrofula, which I soon shall describe more particularly, gout, mania, cancer, spasmodic asthma, and deafness combined as its consequence with dumbness.

Not only is a disposition to these complaints strikingly pronounced in some persons, but other persons appear wholly free from such a tendency—nay, even devoid of the susceptibility of them. Gout, in those *capable* of it, may be acquired by habits, as it may be prevented and repressed by the opposite habits. The habits that, in certain persons, bring it on, are the intemperate use of the luxuries of the table, and an indolent or sedentary manner of life; but there are many people in whom no amount of rich living or idleness will generate gout. So there are some in whom no exposure to impure air, cold, and wet, and no privations—in other words, no appliance of the influences calculated to bring the strumous diathesis into play—will ever produce any form of scrofula; will ever render them consumptive, for instance, consumption being one of the most common and fatal shapes of scrofulous disease. There are many who endure the utmost distress and excitement of mind, yet never become insane. There are many who never become afflicted with asthma, although surrounded by the most powerful exciting causes of that complaint.

Now with respect to these diseases, and perhaps a few others, it is a mattter of fact that they occur much more frequently in persons, some one or more of whose ancestors have suffered from them, than in other persons: the tendency is transmitted, is hereditary.

That the circumstances of the parents *do* influence the physical characters of the children, no one can doubt: it is a matter of daily observation; and one of the best possible illustrations of the fact is to be found in what are called family-likenesses. We see children clearly resembling their father, or their mother; or both parents at once, as mulattoes. The very 'art' of breeders, so successfully exercised in the improvement of horses, cattle, and other domesticated animals, is notorious evidence of the same thing.

It has been suggested that the similarity in features and expression, and even in moral character, which cannot be denied to exist, may be ascribed to training and imitation. But allowing something to that cause, it cannot be all. It was, I remember, a common remark when I was at Cambridge, that the followers and admirers of a very good man, the late Mr. Simeon, appeared to come at last to resemble him. So man and wife are sometimes fancied to grow like each other. That is, the same prevailing cast of thought and feeling, the *idem sentire et idem velle*, may give such an habitual expression and character to the countenance, as shall constitute, to superficial observers, a likeness. But there are family-likenesses which will not admit of such an explanation as this: similarities in the shape or size, or disposition, of peculiar features. Every one has heard of, or may remark in portraits, the hereditary thick lip of the Imperial House of Austria. Many persons now living have had the opportunity of tracing the lineaments of our own Royal Family through at least three generations. The sisters of one of our English dukes are remarkably handsome young women, and bear to this day a striking resemblance to the portraits of their beautiful ancestress, the celebrated Nell Gwyn. And independently of the general cast of features, we trace these family-likenesses in minute or unequivocal particulars, as the colour of the hair and eyes, the shape of the limbs, the stature of the body, and so on: nay, in more decided peculiarities than these, in points of unusual formation. You have heard, probably, of the American calculating boy, Zerah Colburn. A great number of individuals of his family, descended from a common ancestor, had six fingers and six toes instead of five. The peculiarity was transmitted through four successive generations; and probably, could his pedigree have been further traced, through many more. I am myself acquainted with a gentleman who had the misfortune some years ago to have a bastard child laid to his charge. At first he had some misgivings on the subject, and suspected that he might have no title to the credit (or I should rather say to the discredit) of the imputed paternity; but all his scruples were satisfied when he found that the child had six fingers on each hand, for he had himself possessed two small supernumerary fingers, which had been amputated when he was an infant. Haller gives an account of a web-footed family, descended from a mother in whom that configuration existed. There is now living in London a musical composer of some celebrity, in whose person nature has played a similar freak; and whose father, grandfather, and great-grandfather, were all web-footed before him. Beyond this point his information does not reach. I am indebted for the knowledge of this instance to one of my former pupils, Mr. Cooper, of Grafton Street.

Not only the complexion, the features, the stature of the parent, but the various successive phases of the parent's life, mental and corporal, of health and of decay, are often copied and repeated in the child. In the absence of disturbing agencies, the son attains maturity, becomes gray or bald, acquires a stoop or a round belly, loses his teeth and his memory, and finally yields up his life, at about the same age, and after the very same manner, with his father. Particular forms of degeneration and disease unfold themselves at similar periods in both; and thus it is that certain maladies, the tendency to which is interwoven with the original texture of the body, are rightly deemed to be hereditary maladies.

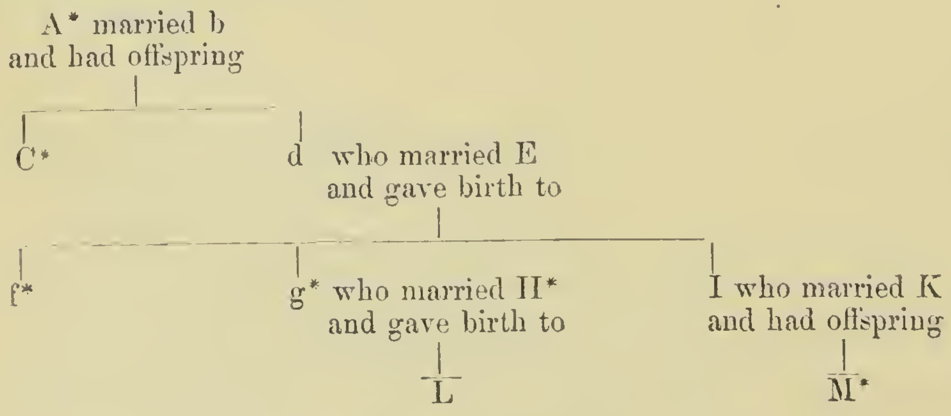
Now there is one very curious circumstance observable in regard to these family-likenesses, namely, that they may fail to appear in the child, and yet appear in the grandchild; may skip over a generation or two; may, after lying dormant, break out, as it were, in some collateral branch of the family tree.

This not only proves that certain physical peculiarities may be transmitted, but it discloses this remarkable property, that peculiarities *not presented nor possessed* by the parent may nevertheless be *transmitted* by him or her; ‘silente sæpe morbo in genitore, dum ex avo derivatur in nepote.[*] This evidently opens a wide field for the operation of hereditary tendencies. A person is not to consider himself as necessarily free from a disposition to consumption or to gout, because his parents have never shown any symptoms of those disorders.

I have never met with a better illustration of what I have just been saying than the following, which I take from one of the journals. It was communicated by Dr. Arthur Mitchell, Deputy Commissioner in Lunacy for Scotland.

A deaf-mute man married a hearing woman and had two children by her, viz., a deaf-mute son, who died childless, and a hearing daughter, who married a hearing man, and gave birth to three children, viz., two deaf-mute daughters, and a son who heard. This son married a hearing woman, and had by her a deaf-mute son. Of the daughters, one is childless, and the other married a deaf-mute, and bore a hearing son.

I here show you a diagrammatic representation of this curious case. Capital letters denote males, small letters females; and an asterisk affixed to a letter signifies that the person was a deaf-mute.



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[*] Boerhaave—aphorism.

If the deaf-mute boy M* were asked whether he inherited his defect, he could answer that neither his parents nor his grandparents were deaf. In them indeed the effect was *potential*, and became *actual* in their offspring M*. If his cousin L were interrogated, he could say that his father and his mother were both deaf-mutes, but he himself hears; yet he may possess the defect potentially. We learn from this example that a defect or disorder may even twice in succession be transmitted potentially; may leap over two generations, and appear as actual in the fourth generation inclusive.

When one parent only bears the transmissible tendency, the disease appears to be most apt to break out in the children who most resemble that parent in their physical conformation and appearance. Yet this is not a universal rule. I am acquainted with a gentleman who has lost several brothers or sisters by phthisis. The fatal disposition is known to exist on his mother's side, while his father's pedigree is believed to be quite free from it. All the children that have hitherto become consumptive have resembled the mother in bodily configuration and features, except this gentleman, who is like his father's family, but who, nevertheless, labours under unequivocal consumption.†

It becomes a very interesting, and a very important question, whether *acquired* peculiarities can be transmitted. I have been told, by a gentleman attending the class, that he knew a man who having been accidentally deprived of sight, afterwards propagated blind children. Such an event, however, is certainly most uncommon, and was in all likelihood accidental. Dr. Prichard was of opinion that all original or connate bodily peculiarities tend to become hereditary, while changes in the organic structure of the individual from external causes during life, end with him, and have no obvious influence on his progeny. Mr. Darwin refers to recorded cases of cats and dogs, of which the tails had been cut short, producing offspring with short or deformed tails. I cannot say that I credit the implied sequence of cause and effect. Blumenbach asserted that in Germany Jews were often born as if circumcised. On the other hand, Mr. Darwin has been assured by three medical men of that faith, that the practice of circumcision, continued for so many ages, has had no inherited effect. Probably the number of prepuceless Christians is as great, comparatively, as of Jews born with that peculiarity. Pits made in the skin by the small-pox were never known to be transmitted by inheritance. I believe in Dr. Prichard's law, although it may not yet be sufficiently established by a reference to actual facts.

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† This gentleman, an eminent London physician, has died since this lecture was given.

This question of inheritance is far too large to admit of more than a cursory reference to it in this place. It is amply discussed, with great wealth of fact and illustration, by Mr. Darwin, in his remarkable book on 'Animals and Plants under Domestication.' I have said enough, however, to convince you of the importance to medical men, and indeed to all men, of a knowledge of these hereditary dispositions. Such knowledge ought to regulate, in some degree, the choice of persons wishing to marry. Where both parents have a decided tendency to any complaint, there will be a double probability of a diseased offspring. Lawful intermarriages between members of the same family are often highly objectionable on the same score. Any inherent defect or morbid propensity is aggravated by what cattle-dealers call 'breeding in and in.'

Again, if it be known that in any family a hereditary proclivity exists—to gout and gravel, for instance, or to consumption—this knowledge ought to warn every individual of that family sedulously to avoid the causes which foster and develop these diseases; and medical men, possessed of the requisite information, may give most valuable advice and instruction on these points.

LECTURE VIII.

Symptoms. Their Uses in relation to the Diagnosis, the Prognosis, and the Treatment of Diseases. Signs, as distinguished from Symptoms. Pathognomonic, Commemorative, Direct, and Indirect Symptoms. Examples of Symptoms as they consist of uneasy Sensations, disordered Functions, or Changes of Sensible Qualities.

We are perpetually reading and talking about *symptoms*: and no wonder, for symptoms are the signals by which we learn that disease is present; the evidence upon which our whole craft proceeds. We are always, therefore, observing symptoms, analysing them, striving to interpret their meaning, to ascertain what they denote. Without a knowledge of symptoms we can have no knowledge of the art of physic. Sagacity in penetrating the import of symptoms constitutes a great part of the skill of an able physician. We shall find it useful to take a cursory view of semeiology, and to familiarise our thoughts with some of the cardinal symptoms themselves, before we speak of them in connection with particular diseases.

What do we mean by a symptom? Συμπτωμα—'Something that happens concurrently with something else.' Symptoms, they say, are *coincidences*, but this is merely translating the word συμπτωματα into English through the Latin. Symptoms are sometimes defined to be *morbid phenomena*—'anything observed in a patient out of the course of health.' But in forming our estimate of disease, we must often take into account functions that are regular and undisturbed: these have been said to furnish *negative* symptoms. For my own part, if I were called upon to define a symptom, I should say, 'Every thing or circumstance happening in the body of a sick person, and capable of being perceived by himself or by others, which can be made to assist our judgment concerning the seat or the nature of his disease, its probable course and termination, or its proper treatment; every such thing or circumstance is a *symptom*.'

And I wish you to take notice at once, that it is for the three purposes just adverted to, that we cultivate the study of symptoms, viz.:—

First, To ascertain the seat, and the kind, of the disease under which our patient is labouring; in technical language, to pronounce the *diagnosis*. I am no great friend to technical phrases when they can be avoided without inconvenience; but in some cases short terms of art save us a great deal of tiresome and needless circumlocution.

A *second* object of the study of symptoms is to enable us to foresee and foretell the probable course and issue of the disease; in other words, to frame the *prognosis*.

And a *third*, and paramount use of a knowledge of symptoms, is to direct our *treatment* of the disease.

I suspect that the immense importance of the first mentioned of these three objects—the diagnosis or *recognition* of disease, is not always clearly seen, either by students or by practisers of medicine. Sometimes we are obliged to prescribe for a malady, although we are in great uncertainty, perhaps in total ignorance, respecting its nature or its situation. But this is always unsatisfactory. On the other hand, when we have ascertained where and what the disease is, we apply with much more confidence, precision, and comfort, those rules for its relief which we have acquired by our own observation, or have been taught by others. This, however, is a very limited view of the importance of an exact and true diagnosis. Diagnosis forms the indispensable basis of all *advances* in physic as a practical art. There is a common saying that the knowledge of what a disease is, is half its cure. In one sense this may sometimes be true, but in another sense it is not so. Almost all that we know concerning the proper treatment of the sick is *originally* derived from observation, *not* of the *nature of diseases*, but of the *effects of remedies*. That rhubarb will purge, and opium lull to sleep, and loss of blood produce faintness, are truths which nothing but experience could suggest, and nothing but repeated observation could confirm. They are purely empirical truths. No one could guess them beforehand. No skill in the discrimination of disease has even a tendency to teach them. In some few cases, indeed, we *see* that certain *mechanical* derangements exist, which are manifestly capable of *mechanical* redress. When parts of the body are displaced, as in herniæ and dislocations; or when distension and pressure are evidently produced by accumulated fluids; the mechanical remedies are at once suggested by the physical and obvious faults. But with such exceptions, diagnosis does not, of itself, afford us *any* direct information as to the cure of diseases; but it does *this*—it defines and fixes the objects about which observation is to be exercised, and experience collected. When we can once identify a given diseased condition, we obtain the privilege of watching the behaviour of that diseased condition, again and again, under the operation of therapeutic measures; and from that time the increase of our knowledge concerning the appropriate management of that particular disease becomes progressive and sure. The term experience is obviously misapplied, and the results of all observation are vitiated, when any doubt exists about the sameness of the objects contemplated. It is mainly to this imperfection in the diagnostic part of medicine that we must attribute the uncertainty and variation, both of doctrine and of practice, which have brought so much suspicion, and reproach, and ridicule, upon the science we profess. *False* experience, if I may use such a term, has greatly hindered the progress of the healing art: and *false experience* springs from *false diagnosis.* A man will tell you that he has cured a score of cases of advanced phthisis; but he has deceived himself: they were not instances of true phthisis, but simply cases of chronic inflammation, with puriform discharge, of the mucous membrane of the bronchi. He publishes an account of his success, and of his plan of treatment; and thus he deceives others also: and thus he retards the science which he fondly and conscientiously believes he is promoting. Accuracy of diagnosis, then, as the foundation of all true experience, and as the guide to rational treatment, cannot be too highly estimated, nor too diligently sought after. It has been wonderfully increased during the last thirty years.

The *prognosis*, or foreknowledge of the course and event of diseases, has but little connection with the promotion of the art of healing; but it is not on that account unworthy of our attention. Both physician and patient find their advantage in the capacity of the former to determine whether a disease be remediable—to foresee the changes that may be expected in its progress—to predict the manner in which it will terminate. Knowledge of this kind opens to us a fair and honourable source of credit and reputation; and it begets a degree of confidence towards us, which is beneficial, not merely to ourselves, but to our clients. Our influence over a sick person, and the efficacy of many of our remedial measures, are remarkably increased by our evident acquaintance with the nature of his complaint, and by the reliance which he therefore places on our skill and judgment. It is often of material consequence, in another point of view, that the fatal character of a disease should be plainly perceived. A sick man, made aware of his danger, is furnished with a motive and an opportunity for arranging his worldly affairs, in the settlement of which the future comfort and happiness of his family may be very deeply concerned; for making his will; and for more solemn preparation for the awful change that awaits him. For these reasons physicians have, in all periods, endeavoured to read, in the phenomena presented to them by diseases, the event to which those diseases severally tend. To *form* an accurate opinion on this head is, however, one thing—to *divulge* it, another. There is always some hazard of losing, instead of gaining credit, by strong statements, and confident predictions of the death or the recovery of a patient. If you give an unfavourable prognosis, you incur the risk of losing your patient altogether. His friends argue, very naturally, that you are not infallible, that you may be wrong, that if *you* know of no means of safety for him, another may; and they *will* grasp at whatever straw comes near them. Do not suppose that this is a merely selfish view of the matter. It is often of much moment to the patient himself, that he should not be tempted to put his life under the charge of impostors, who will feed his hopes, and promise largely, and torture him perhaps with their discipline, and have no mercy upon his pocket. Many an instance have I known of persons dying of consumption, who, when given over by their regular attendants, have been brought to London at considerable expense, exchanging the many comforts of home for the inconveniences of a hired lodging, that they might be *cured* by that ignorant, cruel, and rapacious quack, Mr. St. John Long. There are other reasons, too, why we must sometimes conceal the truth from our patients. It often happens that a person is extremely ill, and in great danger, but yet may recover if he be not informed of his peril. To agitate a person in this state by telling him that he is likely to die, is to lessen, perhaps to destroy, his *chance* of recovery. Your better knowledge harms instead of helping him. You kill him if you take away his hope of living. It must be confessed that the duty of the physician in these cases is very painful and embarrassing. The patient and the patient's friends are urgently inquisitive to know whether there is any danger: or whether he is yet out of danger. The rule which I have always adopted in circumstances of this perplexing kind, when I see clearly that the case is hopeless of cure, is to fix as well as I can upon that person, among the family or friends of the patient, to whose prudence the real state of the matter may be the most safely confided. If I think there is a possible chance of recovery, and that the sick man's knowledge of his danger would diminish that chance, of course I urge the necessity of speaking to *him* with assumed cheerfulness and confidence. If I see that the case is absolutely and inevitably mortal, either soon or at some little distance of time, I leave it to the discretion of the person with whom I communicate, to disclose or to conceal my opinion as he or she may think best. There are men, I believe, who make it a point, on principles of worldly policy, *never* to speak despairingly of a patient; but I cannot regard such a rule of conduct as honest, or justifiable, or consistent with one's Christian duty.

Now I would have you take notice that symptoms do not serve equally or indifferently the three several purposes of which I have been speaking. The same symptom or set of symptoms may indeed at once reveal the nature of the disease, and foreshow its result, and point to its treatment. When we have discovered what the disease is, we may want no further information to tell us how it will terminate, or how we are to prescribe for it. A man previously sound and well, shivers, then becomes hot, and afterwards sweats, and then reverts to his natural state of comfort and good health; and the same series of phenomena recurs every other day. We pronounce the disease to be ague; we predict that, in this climate at least, the patient will recover; and we give him bark; all upon the strength of the same set of symptoms. But it is not necessarily so; certain symptoms may disclose to us what the malady is, and where it is situated; other symptoms teach us whether our patient is likely to survive it or not; and a still different set instruct us what is the proper method of cure to be attempted. We see a number of little pustules scattered over his skin, and we know that our patient is labouring under smallpox. His chance of recovery will be singularly different, according as the spots upon his face run together, or remain separate and distinct from each other: and we investigate the state of his pulse, and of his breathing, of his bowels and of his brain, before we can venture to prescribe for him. Those symptoms, or combinations of symptoms, which declare the place and nature of the disease, we call *signs of disease*; those which teach us what to do, we call *indications of treatment*. We speak also of prognostic *signs*. By keeping these distinct ends of the study of symptoms in mind, we shall be enabled to group them to advantage, and to avoid huddling confusedly together symptoms that speak, not indeed a different language, but upon a different topic. The ancients, who knew but little of the intimate nature of diseases, but who paid great attention to symptoms, have laid down most admirable rules in respect of prognosis: which shows not only that the prognostic signs are more easily made out, in many cases, than the diagnostic, but also that they may be independent of them.

I have just spoken of *symptoms* as being *signs*. These words are not, however, exactly synonymous, although they are frequently employed as if they were so. Even those medical writers who admit a distinction between them, have not always succeeded in clearly pointing out the difference. Signs are deduced from symptoms, by arranging and comparing these, and noticing the circumstances under which they occur. Symptoms are obvious to all persons alike—to the nurse as well as to the physician: signs, for the most part, are such to medical eyes alone. Let me try to make this plainer by the help of an illustration. Symptoms may be considered as resembling so many *words*. When taken separately, or when put together at random, the words have no force or signification. Arrange them in due order, reduce them into a sentence, and they convey a meaning. The sentence is a *sign* or expression of something which is thus revealed. Symptoms become signs when their import can be interpreted.

A certain crackling sound, of which I shall have much to say hereafter, is heard (we will suppose) in some part of a patient's lung, by the ear applied outside his thorax. The sound is a symptom; anyone who listens may perceive it. It is even so far a *sign*, that it denotes the unnatural presence of a liquid in the lung, and the passage of air through that liquid. But the liquid may be one of several—mucus, or serum, or pus, or blood; we cannot tell by the sound alone which of these it is. But if we learn that the person in whose lung the sound is audible has been ill for a day or two only, that he has pain in his chest, cough, embarrassed breathing, and fever, we conclude that he is labouring under that serious disease, *inflammation* of the lung. The crackling sound alone could not assure us of this; nor without the addition of this sign could the pain, the laboured breathing, the cough, or the fever. Taken collectively, the symptoms constitute a *diagnostic sign*, and bespeak the existence of pneumonia.

Sometimes a symptom, or set of symptoms, becomes a sign, through its relation to what has gone before, or to what follows it. To recur to our illustration, the meaning becomes evident from the context. By comparing, at short intervals, in the supposed case of pneumonia, the extent and character of the sounds heard during respiration, we ascertain whether the disease be advancing or receding; and thus convert the sounds, or their variations from day to day, into a *prognostic sign*.

We always strive, then, to penetrate beyond the symptoms to the disease of which they are significant. But we do not always succeed in this attempt, and when we do not (as in the case of ague), we are driven to the necessity of regarding the combination of symptoms as the disease.

You will often hear of *pathognomonic* symptoms. A pathognomonic symptom is one which, when it occurs, settles infallibly the nature of the malady; becomes a positive sign or token of a particular morbid condition. But apart from outward and visible disease, such as a carbuncle, or a cataract, there are very few symptoms, if there be any, which, taken singly, can ever be said to be strictly pathognomonic signs; yet a symptom which in itself possesses little or no value may become very significant when conjoined with others.

Much light is often thrown upon symptoms by what the French call *commemorative circumstances*—that is, by a knowledge of the previous history and condition of the patient. For example, a person may have palpitation and other marks of disordered action of the heart, and doubts may exist whether these symptoms depend or not upon organic disease of that organ. The question is often determined in the affirmative, by our learning that the patient has had one or more attacks of acute rheumatism of the joints. In like manner, previous hæmoptysis may serve to identify suspected phthisis.

There are some other general divisions of symptoms, which it is useful to attend to. Thus some symptoms are said to be *direct* and others to be *indirect* symptoms. Direct symptoms relate to the very part which is affected; indirect symptoms are such as 'declare themselves through the medium of some other parts, or through the medium of the constitution at large.' There are some cases in which the direct symptoms are of much more value than the indirect; and there are other cases in which those which are indirect are the most important; and there are yet many more which require for their elucidation a knowledge of both the direct and the indirect symptoms.

Again, there are many symptoms of which we receive no information, except through the statements made by the patient himself; and there are many others of which we learn the existence by means of our own observation, by the exercise of our several senses. The relative importance of *these* varies too in different cases. Of course those symptoms which we are able to ascertain for ourselves are the most *trustworthy*; but both sorts of symptoms shed mutual light upon each other. We should constantly be making mistakes if we relied solely upon what our patients tell us. On the other hand, the value of the information we derive from their statements is made apparent by the difficulty we are apt to experience in investigating the diseases of children; of those who are dumb; or, what is much the same thing, who speak no language that we understand.

Now, setting aside that notice of the healthy functions which is sometimes necessary in order to determine the relative value and meaning of other symptoms, and regarding those symptoms only which consist of *morbid* changes, they may all be classed under three heads: 1. Uneasy, unnatural, or impaired *sensations*: 2. Disordered or impeded *functions*: and 3. Alterations of structure or of appearance; changes of *sensible qualities*. When these last come within the direct cognisance of our senses, they are called, usually, *physical signs*.

Uneasy or altered sensations we can only be aware of through the testimony of the patients themselves. The symptoms belonging to the other classes fall, generally, under our own notice.

Uneasy or altered sensations comprehend a large class of morbid symptoms. By their occurrence persons sometimes become conscious that they are unwell before any other symptoms are observable. Of all the uneasy sensations *pain* is the most common and the most important. It rarely happens that it is not felt, at one period or another, in inflammatory disorders; and it very often occurs, and is very acute too, when there is no inflammation at all. I shall have occasion, in a subsequent lecture, to lay before you the criteria between pains that accompany inflammation, and pains that are independent of it. Upon that point of distinction the whole question of treatment commonly depends; and it is often a most difficult point to determine.

There are many different kinds and degrees of pain. Different kinds of morbid alteration are accompanied by different kinds of pain; and the same kind of morbid alteration—inflammation, for example—produces different modifications of pain, according as it affects different parts. The pain that belongs to inflammation of the lungs differs from that which is felt in inflammation of the bowels. Bones, muscles, tendons, ligaments—the bladder, the kidney, the uterus—all modify, in a manner peculiar to themselves, the pain that is produced in them by injury or disease. Different epithets are given to the different varieties of pain—i. e., persons endeavour to explain how they feel, by likening their sensations to something which they have felt before, or fancy they have felt. Thus we hear of *sharp* pain—*shooting* pain—*dull* pain—*gnawing* pain—*burning* pain—*tearing* pain; and so on.

If pain be felt in a part, only when it is touched, i. e., when *pressure* is made upon it, the heightened sensibility is called *tenderness*:—the part is said to be tender. This is a very important kind of pain, as we shall see hereafter. A part may be both painful and tender: or painful without being tender: or tender without being otherwise painful.

Pain often is felt, not in the part really affected by disease, but in some distant part. Inflammation of the liver or diaphragm may cause pain in the right shoulder: the mechanical irritation of a stone in the bladder produces pain at the extremity of the urethra: inflammation of the hip-joint excites pain in the knee: disease of the heart is often attended with pain running down the left arm: many headaches result from irritation of the stomach. We call these, instances of indirect or sympathetic pain. Some of them admit of no very obvious explanation:—others have been ascribed to connections between the sentient nerves of the two parts; 'especially when the part really injured is internal, and that to which the feeling is referred is external, and both derive their sentient nerves from the same larger branches.' You will perceive that a due estimation of these sympathetic pains is of no small importance.

I may observe of pain in general, that it is differently felt—or at any rate differently complained of—by persons of different constitutions and temperaments. There are even, I fancy, *national* differences in this respect. I have been present, as you may believe, at a great number of surgical operations, and I have been struck with the different manner in which the same sort of operation has been borne by Irishmen and by Scotchmen. The Irishman, generally speaking, either feels more acutely, or gives more free vent to his feelings in cries and exclamations: the Scotchman, on the contrary, most commonly preserves a resolute silence. In complaints that are associated with low spirits and hypochondriacal feelings, there is reason to believe that the pain spoken of often depends, in a great degree, upon the eager attention that is paid to it. The accounts given by such patients of their sufferings are always to be received with a grain of allowance; and this is sometimes an embarrassing circumstance in practice. Patients take it ill if they do not seem to be implicitly credited; and yet if they are not convinced that much of what they suffer depends on their undue attention to it, they will never get well. You will often find that they cease to feel pain—i. e., they forget to think of their complaints—when their attention is otherwise strongly arrested; as by conversation, or by music. I adverted to this principle in my last lecture.

The pain of various painful diseases admits of relief, in various degrees, from the resources of medicine. The pain, more dreadful and more dreaded, and so long exacted, in the capital operations of surgery, as the inevitable price of future ease, or as the instant ransom of life, has happily found, in our times, its specific antidote. By the mere breathing, for a few minutes, of an invisible vapour, the corporal sensibility is laid asleep, and the knife, the gorget, or the cautery executes, at leisure, and unfelt, its terrible but salutary work. To 'charm ache with air' is no longer the poet's mock. Half-a-century ago was this blessed invention suggested by the sagacious mind of Sir Humphry Davy; but his hint fell profitless upon our negligent ears, and the glory and the triumph of the discovery (for in such things to proclaim and publicly to apply is practically to discover) was reserved for our brethren beyond the Atlantic. The safety, as well as the efficacy of this application of the vapour of æther, of chloroform, and of nitrous oxide gas, the very vapour proposed by Sir Humphry Davy, has now been ascertained by abundant experience. And if we consider what this practice has done, and what it promises—the vast amount of torturing pain which already has been spared to thousands of our race, and which countless generations yet unborn may thus escape—and not the bodily anguish only, but the mental terrors of its prospect, and the agitating recollections of its actual sufferance—and, still further, the improved chance of ultimate well-doing which the avoidance of so severe a shock to the nervous system is found to confer—we shall scarcely deem the proposal extravagant, which has been made by one of our hospital physicians, that for so merciful a boon to suffering humanity, public thanksgiving should be humbly offered up to Heaven in our churches.

Here, as in many other instances, it is curious to note how closely a great discovery may be approached, and yet missed. Long before its power was used to prevent the inflicted pain of surgical operations, the vapour of æther had been successfully employed to suppress the inbred sufferings of natural disease. A former patient of mine told me this story of herself. She had been sorely tried, in her earlier years, with paroxysms of urgent dyspnœa, frequently recurring; and her life was thought to be in danger. After fruitless trials of various other remedies, the following method was adopted, with the happiest result, under the advice of a physician of high promise, who died young, the late Dr. Woolcombe, of Plymouth.

About two tea-spoonfuls of sulphuric æther were poured into a saucer, which was placed on her lap, and over which she breathed, as she sat gasping in bed, with a shawl thrown over her head to prevent the escape of the vapour. Very soon a delightful sensation of tranquillity ensued; she felt (I quote her own words) 'as if going to heaven in the most heavenly way;' and presently she sank back unconscious. As soon as this happened, her husband (the late distinguished Admiral of the fleet, Sir T. Byam Martin), by whom the process was managed, withdrew the shawl, and in a short time Lady Martin gradually recovered, breathing calmly.

This mode of quieting her attacks of asthma was begun in 1806, a few years after the publication of Sir Humphry Davy's hint: and it was repeated again and again, sometimes twice in the same day, for a very considerable period. Lady Martin survived the prediction of her early death for forty-three years.*

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* 'Is there anything whereof it may be said, See, this is new?'

In turning over the pages of an Italian work, presented to the British Museum in 1853, one of the trustees lit upon the following curious passage:—

'Fra i Toscani scrittori di qualche pregio in chirurgia, mi si presenta in primo luogo Ugone da Lucca, nato poco dopo la metà del secolo XII. della nobile famiglia Borgognoni. Esso Ugone fu capo della setta dei cerusici, che medicavano le ferite con vino, stoppa e conveniente legatura, e gli riusciva felicemente. Aveva anche della pratica nella chimica; e di lui si ha il processo per la sublimazione dell' arsenico, descrittoci da Teodorico suo figlio. Il quale ci descrive anche certo olio *de lateribus*, preparato chimicamente da suo padre, ed un suo caustico potentissimo, *ed un soporifero che per mezzo del solo odorato assopiva i malati, in occasione di operazioni dolorose, che dovessero soffrire.*'

'Notizie sulla storia dello scienze fisiche in Toscana cavato da un manoscritto inedito.'—*di Giovanni Targioni-Tozzetti.* Firenze, 1852.

So that the practice of benumbing the sensibility of a patient about to undergo a surgical operation, by causing him to inhale an anæsthetic vapour, is as old as the 12th century.

Like most other blessings, this merciful gift is not without its measure of alloy. For the hope of ease the heavy price of life has from time to time been paid, even in surgical operations which are not considered capital; such as the evulsion of a toe-nail. But here again art steps in, and succeeds in at least limiting the frequency of the peril. To prevent the pain incidental to the minor operations of surgery, Dr. James Arnott, more than twenty years since, recommended the benumbing power of cold. His proposal did not, however, obtain much favour or currency, until Dr. B. W. Richardson devised a more simple and ready method of procedure than Dr. Arnott had used. By means of evaporating fluids applied in the form of spray, any external or accessible part of the body may now in a few seconds, at a very trifling cost, without any difficulty, and with absolute safety to life, be deprived entirely, for a sufficient time, of the faculty of sensation; in one word, be temporarily *frozen*. It is interesting to watch the process, to see the surface of the part, reddened possibly by previous inflammation, suddenly whiten, as by a reversed blush, when the congelation is complete, and the sense of pain abolished. This supplement of the inhalation of anæsthetic vapours makes a very large addition to the debt that humanity owes to science.

Besides pain, in all its modifications, there are many other, and very interesting, uneasy sensations. *Itching* is an uneasy sensation nearly allied to pain. As severe mechanical irritation

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During the earlier part of his life, the Theodoric mentioned in the foregoing extract studied surgery, and followed his father Hugo's calling. He afterwards entered the Church, and became bishop, first of Bitonto, and, finally, of Cervia. In his 'Chirurgie,' of which the Library in the Museum contains more than one copy, he made public the chemical preparations and the rules of his art, which Hugo had jealously kept secret from all, except his son. I owe to Mr. Panizzi's kindness the opportunity of transcribing the formula for preparing and using Hugo da Lucca's *soporific*.

'Confectio saporis a chirurgia facienda secundum Dominum Hugonem sic fit.

'℞. Opii, et succi mori immaturi, hyoscyami, succi conidij, succi foliorum mandragoræ, succi ederæ arboreæ, succi mori sylvestris, semi-lactucæ, seminis lapathij quod habet poma dura et rotunda, et cicutæ, ana unciam.

'Hæc omnia in unum commisce in vase æneo; ac deinde in istud mitte spongiam novam, quod totum ebulliat: et tamdiu ad solem canicularibus diebus donec omnia consumat: et decoquatur in ea: quoties autem opus erit, mittas ipsam spongiam in aquam calidam per unam horam: et naribus apponatur: quousque somnum capiat: qui incidendus est: et sic fiat chirurgia: qua peracta ut excitetur: aliam spongiam in aceto infusam, frequenter ad nares ponas.' — Theodorici de Luca Episcopi Cerviensis *Chirurgiæ* lib. 4, ch. viii.

will cause pain, so a slighter degree of it will cause itching. Itching occurs in many cutaneous diseases, and it gives a name to one of them, which is called emphatically *the itch.* And the Latin word signifying the same sensation, *prurigo*, is made use of to denote other forms of disease of which itching is the most prominent symptom. It often affects some one of the natural outlets of the body. It occurs about the rectum, from the motions of little worms that nestle in the lower part of that gut. This prurigo podicis, which does not always depend on the cause just mentioned—and the prurigo pudendi of women—are sometimes most distressing complaints; harassing the patients continually, preventing sleep, excluding them from society, and requiring medical treatment. Acrid matters in the intestines will sometimes produce a kind of itching there; and the call to void the fæces is perhaps more akin to itching than to any other sensation: sometimes, indeed, it amounts to pain. The tickling often felt in the windpipe and provocative of cough, appears to be of the same nature. Tingling and pricking are sensations which have also some analogy to itching.

Nausea is another uneasy sensation. It is sometimes a *direct* symptom of disease or disorder of the stomach, to which the sensation is referred. Sometimes it is a very important *indirect* symptom, taken in conjunction with others, of disease in some part at a distance from the stomach—in the kidney, for example, or in the brain. The nausea which is so troublesome to pregnant women is another instance of a morbid sensation sympathetic of some change in a distant organ.

Another example of an uneasy sensation we have in *giddiness* or *dizziness*—technically *vertigo.* It sometimes results from disease within the head; sometimes it is an indirect consequence of disorder of the stomach; of disease of the heart; or of mere debility and an approach to syncope.

Patients will also complain of an undefinable sensation which they usually call *sinking*—a sensation which is referred to the epigastric region. This is frequently a source of much distress to hysterical women; and it is occasionally the forerunner of death at the close of severe diseases which have a tendency to end fatally in the way of syncope.

Many other symptoms might be mentioned which belong to this class of uneasy sensations, and for our knowledge of the existence of which we must depend upon the accounts given us by the patients themselves. Sensations of weight; of tightness and fulness; drowsiness, tenesmus, strangury, heartburn;

and various depraved conditions of the special senses. In the majority of diseases the appetite is lost or impaired; but sometimes excessive hunger accompanies and denotes disease. We occasionally derive the first suspicion of the existence of diabetes from the preternatural keenness of the appetite. Thirst is a very constant and striking symptom in all febrile and inflammatory disorders: and in the disease just now mentioned, diabetes, it frequently constitutes the whole distress of which the patient is sensible. The appetite may be perverted, as well as deficient or excessive. Chlorotic girls will eat cinders, egg-shells, sealing-wax, slate-pencil, and such trash. So women who are pregnant either have or pretend to have inordinate longings for particular kinds of food—longings which are evidently fostered by encouragement. They are not, I believe, common at present in this country; and they are less frequently heard of among the poor, who have not the means of gratifying them, than in the higher ranks of society.

The class of uneasy sensations you see then is a very large one, and some of the morbid feelings are of very great moment. However, there are not many diseases which consist altogether of uneasy sensations; and when we find that pain or uneasiness is complained of in any part or organ, we next proceed to enquire whether the *functions* of that part or organ are disturbed or suspended. If we discover any interruption or derangement of function, we have additional reason for concluding that the part so affected in its sensations and in its functions is actually the seat of disease. This is an enquiry which we can prosecute with much less assistance from the patient himself; and mostly with no assistance at all; and even in spite of any erroneous opinions which he may have formed, and may be anxious to state upon the subject. The study of disordered functions is of great practical value.

The functions of the brain and nerves—of the heart and blood-vessels—of the respiratory apparatus—and of the digestive organs—are all of vital consequence.

Some of the impeded or disordered functions which relate to the brain and nerves are, in fact, identical with the last class of symptoms, and consist of altered or morbid *sensations*: sensation being one of the natural functions of those parts. Depravations, for instance, of the sense of touch; numbness; the total absence of sensation, which we call anæsthesia. Symptoms of this kind do not constitute primary diseases, but they often portend or accompany very serious alterations in the brain, or in some part of the nervous system: and it is from that circumstance that they derive the great interest and importance which belong to them. The same may be said of perverted conditions of the other senses. The sense of vision is often impaired, and in various ways and degrees, from mere dimness or imperfection of sight, to total blindness. And this total blindness may occur without any other *apparent* disease, the humours and fabric of the eye itself being in all evident respects healthy and right; at least, when viewed in the ordinary way, by the unaided eye of another. The modern invention of the ophthalmoscope circumscribes the number of instances of blindness without apparent disease. Total blindness of one eye may come on, too, so gradually, and increase so slowly, as not to be perceived for a long time, even by the patient himself. Mr. Day, the great blacking man, of the firm of Day and Martin, who died not long since, was almost entirely blind. He told me he first discovered that the sight of one eye was gone, one day when he attempted to look at a distant object through a telescope. He could see nothing, and he imagined that the little brass plate which slides over the eye-glass had not been withdrawn. There was, however, no such obstacle; and he found too soon that when the other eye alone was closed, he was in total darkness. This state of blindness is called amaurosis, and it may result from morbid changes in the retina, or in the optic nerves, or in the brain at or around the origin of those nerves. There are other causes also, to be mentioned hereafter, of amaurosis. Its approach is sometimes marked by the fallacious appearance of black spots upon the objects the patient is looking at, or floating before him like flies or cobwebs in the air—*muscæ volitantes.* Some of the other depravations of sight are still more extraordinary, and except that they are not uncommon, might almost be considered fabulous. Thus persons sometimes see things around them apparently in motion, when in truth they are not so. This is, in fact, a symptom I have mentioned before—vertigo. When the patient shuts his eyes, and consequently can see nothing, he feels as if he were himself turning round, while in reality he is at rest. Persons in this state fancy sometimes that the bed on which they lie is sinking rapidly down with them into some abyss. A still stranger depravation of the sense of vision is that in which a person sees only one half of an object at which he is steadfastly looking. One man, in passing along the street, imagined that everybody he met had only one eye. The late Dr. Wollaston was subject to this optical defect: he frequently found that only one half of the object he looked at was visible: and he wrote in the 'Philosophical Transactions' an ingenious paper to explain this. After his death a tumour was found in his brain, interfering with the optic nerves. The celebrated Mr. Abernethy had once a temporary affection of the same kind, dependent, no doubt, upon some slight and transient injury of the brain. He was thrown, I believe, from his horse—at any rate, he received a violent blow on his head, which stunned him; and when he had recovered a little, he was taken home in a hackney-coach. On his way he amused himself with reading the names of the trades-people placed in front of the shops, and he was greatly surprised to find that one half of each name—the last half—seemed blotted out. He described this in his lectures, after his whimsical manner, by taking his own name as an example: 'I could see as far as the *ne* (said he), but I could not see a bit of the *thy.*'

Those very wonderful cases of spectral illusion which sometimes occur, come within the class of symptoms we are now considering; they throw a strong light upon many of the well-authenticated ghost-stories—which were in fact merely instances of disease or derangement in the brains of the ghost-seers. It would be out of place to go into any detail upon this interesting subject here. You will find some excellent examples of these spectral illusions in Dr. Hibbert's book on 'Apparitions,' in Sir David Brewster's 'Natural Magic,' and in Sir Walter Scott's 'Letters on Demonology.'

The sense of hearing is liable to analogous disorders. Sometimes it becomes preternaturally acute; and this is a bad symptom when it does occur. I was called a year or two ago to see a gentleman in the Temple; he had been taken ill only a few hours before, but I found him dying; the pulse was gone from his wrist; and his skin was cold. His intellect, however, was entire, and he complained of nothing but the distress he felt from the loud noises that were made by those around him, in moving about and in speaking, although, in fact, all noise was as much as possible suppressed, and conversation was carried on in whispers: but his hearing was painfully acute. He died the same evening; I believe of an irregular form of cholera. It is always right that patients should be protected from the irritation which might arise from this source; for that degree of noise which would not interfere with the sleep of a healthy person will often not only prevent it in a sick man, but bring on delirium, and aggravate greatly the disease under which he labours. The custom of strewing the streets with straw before the houses of those who are seriously ill is, in many cases, a very proper precautionary measure.

The opposite fault, *obtuseness* of hearing, is much more common. Deafness is frequently attributable to some physical imperfection in the organ of hearing. But it is with cases in which it has a deeper origin that the physician is chiefly concerned. It often occurs in fevers, and is not then thought a bad symptom: it certainly is a much less unfavourable circumstance than morbid acuteness of hearing; and it probably depends upon a disordered state of the brain, which is not in itself very dangerous.

What is called *tinnitus aurium* is an instance of the depravation of the sense of hearing. It seems sometimes to result from the too strong throbbing of the arteries. It occurs in many disorders, and is not unfrequently a symptom of diseased cerebral vessels, and a precursor of apoplexy or palsy. It is sometimes in itself extremely annoying. Curious and undefinable sounds are heard by some patients—sounds as of a rushing wind, as of the falling of a cataract, the ringing of a bell, or the beat of a drum. A female patient of mine in the Middlesex Hospital last year, who had disease of the bones of one ear, with symptoms that threatened some implication of the brain, affirmed that she heard a perpetual noise in her ear like the singing of a tea-kettle. I have lately been consulted by a gentleman from the country, who had no other complaint than a constant hissing, which worried him greatly, in one ear. Another had watched with curious anxiety, and described to me very graphically, the successive variations which this troublesome symptom underwent in his own person. It began suddenly, with some headache. At first it was a loud roaring, like that of the sea; in a few days it came to resemble exactly the whistling of the wind among the trees in winter; afterwards he could have believed that the room was filled with humming gnats; and finally the noise settled down into the gentle sound of a distant waterfall. It haunted him incessantly for seven years. Then came an attack of shingles on the right side of his head, face, and neck, and the noise at once ceased. It left him free for a year and a half, and then returned as before. Sir David Brewster relates the case of a lady, subject to spectral illusions, whose ear was mocked by unreal sounds, as her eye by unreal visions. Being in her right mind, and perfectly aware of the infidelity of her senses, she repeatedly heard, not vague noises merely, but voices and sentences, when none were uttered. This is far from being uncommon.

Affections of the intellect—of what are sometimes called the internal senses—are very common, and very important symptoms of disease. Incoherence of the trains of thought—palpably false belief—extravagant perversions of the judgment. These affections are sometimes considered as primary diseases themselves; they very frequently accompany certain febrile diseases; and they are not uncommon in diseases that are unattended with fever. There is more or less derangement of the internal senses from the very beginning of continued fevers. The power of attention is impaired. That kind or degree of mental exertion which would afford gratification and amusement when we are well, becomes laborious and irksome when we are ill; and to compel, or to urge, the attention, under such circumstances, is injurious. This state is probably only the first degree of delirium, and therefore these slight approaches to derangement of the internal senses are by no means to be disregarded. It is curious that the delirium of fever is always most marked during the night; this seems to be owing to the circumstance that the erroneous notions and wandering thoughts of the patient are not corrected by impressions made upon his external senses. You will find, conformably with the same principle, that your patient sometimes ceases to be delirious upon your visiting him: the sight of a new face rouses him for a time, but he soon relapses.

Strange infirmities of the memory there are, associated with cerebral disease, and justly to be regarded among its symptoms: large blanks in the backward gaze; fitful suspensions of the remembering power; partial glimpses of the past; resurrections of thoughts long buried in oblivion. I speak not of that natural decay of the memory which is noticeable in most persons as age creeps on, and which is one of the most affecting of the many warnings then vouchsafed to us, that the bodily frame is suffering dilapidation. Even of this natural decay there are some curious things to be noted. Recent events are retained with difficulty, and soon forgotten; while those of older date are easily and accurately recalled. This has been referred, and rightly I believe, to the differing degree of interest and therefore of attention which the same objects excite in the young and in the old. It would seem as if the effort of attention stamped characters upon the material fabric, which are deep and lasting in the youthful brain, faint and sooner effaced in the aged. But disease may revive things long forgotten; a language long unspoken and unthought in: or blot out entirely all traces of definite portions of time gone by, and even all previous power of speech and language.

Voluntary motion is another function connected with the nervous system, and one which affords a great variety of important symptoms. Like the power of the senses, it may be excessive, or deficient, or perverted. Excess of voluntary motion is not common, nor very important. Maniacal patients sometimes exhibit an extraordinary degree of muscular strength; indeed, in the delirium of fever something of the same kind may be observed.

But the opposite state, that in which the power of voluntary motion is deficient, muscular debility, is exceedingly common. Debility is an original and essential part of fevers. It appears before there has been time for it to be produced by the mere exhaustion of disease. It is not always proportional to the other symptoms, and does not necessarily imply any great degree of danger. This sudden and early weakness has been a very striking symptom in our two or three recent visitations of influenza. Persons previously in apparent good health would be seized as they walked along the street, and be glad to sit down in a shop, or a carriage, and to get home and go to bed. Young and strong persons would be thus rapidly prostrated.

In some instances debility does not appear till late in the disease, of which it then forms an important prognostic symptom, and an important guide for our treatment. It shows us that there is a tendency to death by asthenia, and we have to endeavour to keep the patient alive by supporting his strength as well as we can, this being the chief, or perhaps the only indication.

Debility is occasionally the principal symptom of the whole disease—as in hemiplegia, paraplegia, or in more partial palsy, palsy of one limb, even of a finger, or of a single muscle, as of the levator palpebrarum. This, though it may seem trivial in itself, is far from being so in reality; it often forms a fragment only of a most serious disease. From such partial manifestations of palsy we presage a more general and alarming attack; as the loosening of a few stones in the wall announces the commencing earthquake. A slight degree of paralysis affecting some of the muscles of the eye will produce a squint, and consequent double vision; and this occurs not only in hydrocephalus, when it is a most significant phenomenon, but also as a prelude to more extensive palsy. General palsy is sometimes prefaced by a similar affection of the tongue, producing a faltering and indistinctness of speech.

Spasm is an instance of disturbance and perversion of the power of voluntary motion. It consists in an irregular and violent contraction of muscular parts—involuntary, even when the voluntary muscles are concerned. Cramp is a familiar example of it; and we have been taught, since the cholera came among us, to regard cramp as sometimes a very formidable symptom: not formidable so much in itself, as formidable in respect of the condition that gives rise to it. Tonic spasm is the principal symptom also of that frightful disease—frightful in its phenomena and in its frequent fatality—tetanus. The convulsions of epilepsy and of hysteria, and the jactitation of chorea, are ordinary examples of the perversion of the function of voluntary motion. Sometimes convulsions bode great danger, sometimes none at all.

So also *tremor*, which is near akin to spasm, is a sign, frequently, of a morbid state of the greatest peril; while it is sometimes violent without being attended with the smallest hazard.

If we turn now to the great function of respiration, we shall find that it affords a very large number of morbid symptoms, and those of the highest importance.

Dyspnœa, difficulty of respiration, is one of the most prominent of these symptoms. It may depend upon various causes. It often results from disease of the heart. In inflammation of the lungs or pleuræ there are several circumstances in operation to impede the breathing; for example, pain, which would be enough in itself; the effusion of lymph into the texture of the lung, or of serum into the cavity of the pleura, mechanically resisting the entrance of air; obstruction of the pulmonary artery. In dyspnœa the breathing is almost always most difficult when the patient is lying flat on his back. One reason for this is plain. In the supine horizontal posture the action of the diaphragm is obstructed by the weight and pressure of the adjacent abdominal viscera; and the erect position obviates this. Upright breathing, *orthopnœa,* has come to be considered as a distinct modification of dyspnœa. The patient cannot lie down.

Sometimes, as in asthma, the difficulty of breathing comes on in separate paroxysms; the respiration becomes all at once noisy, wheezing, and laborious. A person who had never seen any cases of this kind would imagine that the patient was at the point of death—that it was all over with him; but the most frightful of these attacks are seldom attended with any *immediate* danger. They depend frequently upon organic disease of the lungs, heart, or aorta: sometimes they seem to be purely spasmodic; sometimes to proceed from transient congestion of blood in the lungs.

Cough is a violent spasmodic action. A full inspiration is taken; then the glottis is closed pretty firmly, the lungs are forcibly compressed by the action of the respiratory muscles upon the walls of the chest, and in expiration the air is shot suddenly out through the glottis and mouth, and with it, frequently, mucus, or other matters which had irritated the air-passages. It is for the most part an involuntary effort of nature to expel from the lungs things which ought not to be there. There are several varieties of cough. It is a symptom belonging to so many dangerous complaints—pneumonia, pulmonary consumption, and diseases of the heart—that it always demands strict attention. No one who has once heard it can ever mistake the *hooping* cough. There is also a startling obstreperous sort of cough, shattering one's ears almost, like the noise of a person coughing through a brass trumpet—which depends upon some peculiar state of the nervous system, implies no danger, and is more distressing to the bystanders than to the person who utters it. I believe you may often distinguish the cough of inflammation of the lungs from that of phthisis, and each from the cough of hysteria, by their respective sounds: but we have much better methods of distinguishing them—viz., by the concurrence or the absence of certain other sounds belonging to the breathing, and to be ascertained by auscultation.

Sneezing is another morbid symptom, which, though it may appear trifling, is not to be overlooked. The air is driven through the nose, the cavity of the mouth being shut off. This is a very common symptom in catarrhal affections. When sneezing occurs in combination with cough, it affords a *presumption* that the cough is not phthisical. Sneezing may even happen as a primary disorder, occurring in long-continued paroxysms. I have at present under my care a young lady of a hysterical disposition, whose main distress consists in violent and protracted attacks of sternutation, which have harassed her almost daily for many months. One of our bishops is subject to very inconvenient fits of this kind. He will begin to sneeze, and go on sneezing incessantly for a long time together. I believe that he finds a temporary remedy for these attacks in plunging his head into cold water.

Sneezings, coughs, paroxysms of asthma, are all of them instances of *reflex* action. What is meant by that epithet I shall tell you in a future lecture.

I say nothing here of those direct symptoms of pulmonary disease which are ascertained by the sense of hearing—by auscultation and percussion. I shall enter fully into that subject hereafter. A systematic account of symptoms, if this were the fitting place for it, which it is not, would require a dozen or twenty lectures. In order to perceive the relation of symptoms, taken one by one or in diverse combinations, to the various known forms of disease, you must have some prior knowledge of diseases. But I am obliged to suppose (however incorrect the supposition may be with respect to some among you) that you are mere beginners, and have still to learn even the rudiments of such knowledge. Different diseases may have many symptoms in common. The same symptom may bear a very different import according as it is combined with other symptoms; or connected with this or that disorder. The proper place for a comprehensive and complete review of symptoms would, therefore, be at the *end* of a course of lectures on the practice of physic. When the various forms of disease had been gone through, with reference to the symptoms belonging to them, then would be the time to take the converse aspect of the case, and to consider the long list of symptoms with reference to the diseases they denote or accompany. All that I am at present attempting, is to give you some general notion of what symptoms are; to put before you, as samples, a few of the most prominent; and to show you, even by this cursory and imperfect view of them, of how great importance it is that we should make their relations to each other and to different diseases, and their signification, diagnostic, prognostic, and therapeutic, the objects of our most diligent attention.

I might find matter for two or three lectures, if my present purpose would admit of them, in the symptoms that are drawn from the functions belonging to the *circulation*. Everybody knows how much importance is attributed to the state of the arterial pulse. It is expected of us, as a matter of course, that before we think of prescribing for a patient we should at any rate feel his pulse. And really the information obtained by that little touch of the wrist is often of the most interesting and instructive kind. But it requires practice and intelligence to appreciate this information. The qualities that we most attend to in the pulse are its frequency, its regularity, its fulness, and its force. It is necessary that we should know the number of beats which the heart habitually makes in health; for it varies much in different persons. Its average number of pulsations in a healthy adult is from 70 to 75 in a minute; but there are persons who, when they are quite well, have always a pulse of 80 or 90; and there are others in whom the pulse seldom rises above 60. In early life the pulse is more frequent, in old age it is more slow, than the standard I have given. *Cæteris paribus*, its beats are more numerous in the standing than in the sitting posture; in the sitting than in the recumbent. If we do not inform ourselves of these peculiarities, we may fall into great mistakes. In disease the pulse may acquire a degree of frequency which is scarcely calculable by the touch; and the less so because, when it is extremely frequent, it is also extremely feeble; it will reach 150, 160, or even 200 beats. I have myself reckoned, by aid of the stethoscope, 216 pulsations of the heart in a minute. On the other hand, in apoplexy sometimes, or when syncope is impending, or in certain organic affections of the heart, the pulse may become extremely slow. I do not remember to have counted a pulse slower than 22; but the gentleman whose pulse it was—a most exact observer of its changes—had numbered it when no more than 16. In another patient of mine, the surgeon who was also in attendance reported the pulse to have been, upon one occasion, 12 only; and I have been informed that in an old gentleman, whose spinal column had sustained some injury, and who was Dr. Chambers's patient, the beats of the pulse were for some time as few as 9 in the minute. I suspect that in some of these instances of very slow pulse, the stethoscope might detect, at the heart, intermediate weaker beats, too weak to stir the radial artery. But I satisfied myself that it was not so in the case in which I found the pulsations to be 22. We learn a good deal in certain disorders from the *variations* and *fluctuations* of the pulse in respect of frequency—in hydrocephalus, for example, and in continued fevers.

Irregularity of the pulse is another condition which is often full of meaning, and of interest. I hope, as the lectures proceed, to be able to point out the bearings of these several qualities of the pulse upon our views of disease, and especially upon its treatment. At present I must repeat that I pretend to do no more than furnish you with a few samples of the phenomena that characterise disease. Irregularity of the pulse is natural to some persons. I have a brother whose pulse in his best state of health is habitually irregular: I have been told that when he was ill with a fever at school, it became regular. I have heard of several precisely similar cases. There are two varieties of irregular pulse—in one the motions of the artery are unequal in number and force, a few beats being from time to time more rapid and feeble than the rest: in the other variety a pulsation is from time to time entirely left out—the pulse is said to intermit. These two varieties may coincide in the same person, or they may exist independently of each other.

Irregularity of the pulse may be caused by disease within the head; by organic disease of the heart; by simple disorder of the stomach; or it may be merely the result of debility, and the prelude to the complete stoppage of the heart's action from asthenia. How important must it be to ascertain and construe each of these meanings of the same symptom. It may indicate mortal disease—it may imply no danger at all: it may afford no clue to any available treatment; or it may teach us how to ward off impending dissolution.

Another important quality of the pulse is what is called its hardness, or incompressibility. You find that you can scarcely abolish the pulsation by any degree of pressure; the blood still forces its way through the artery beneath your finger. Sometimes it is felt to strike a large portion also of the finger, and then we say that the pulse is full, or large, as well as hard. When it strikes a very narrow portion of the surface of the finger, it is compared to a thread; it is a small pulse: and if at the same time it be hard, such a pulse is often described as a wiry pulse. It requires some education of the finger to appreciate with exactness the several varieties of the pulse, even those which are practically important; for many have been mentioned by authors which are purely fanciful, or useless and unnecessary refinements.

Our estimate of the vital conditions of the circulation will become, I make no doubt, more and more definite and accurate in proportion as the management and the language of the newly-invented sphygmograph become more familiarly known among us.

Before I conclude this rough review of symptoms, I must point out one or two that belong to the third class mentioned; viz., changes of sensible qualities. These include variations in the temperature of the body: in the colour of the surface, and especially of the face: the diminution or increase of bulk; the latter, when general, we call corpulence; when partial, swelling: and various other symptoms, especially those which are detected by auscultation.

Fluctuations in the general temperature of the body, as measured by the thermometer, furnish lessons of great interest and value in relation to the diagnosis, the prognosis, the duration, and the fitting treatment of many forms of disease. Till lately this field of enquiry has been very imperfectly cultivated; but it is fertile of instruction.

Wasting, or emaciation, is sometimes the first observable symptom of disease. This is early seen in the countenance, partly because it is uncovered, partly because a slight diminution of the subcutaneous fat of the face produces a striking alteration in its features. It occurs in complaints that are not commonly dangerous—as in dyspepsia, and in hypochondriasis, which is often connected with dyspepsia: and when it does appear it marks the reality of the disease. This wasting happens also in many fatal maladies—in phthisis pulmonalis, for example—and in dropsy, although the dropsical enlargement sometimes masks it. It accompanies many acute diseases, and is reckoned an unfavourable symptom; for it shows that the body is not properly nourished. Sometimes the emaciation is so extreme that the integuments give way—the bones of the patient are said to come through his skin.

We have examples of symptoms that consist in changes of colour, in the flushed face of fever; in the pallor belonging to many diseases; in the contrast exhibited by the white cheek with its central red spot, so characteristic of hectic fever; in the yellowness of the skin and of the conjunctivæ in jaundice; in the dusky hue of the countenance and the lividity of the lips noticeable whenever the due arterialisation of the blood in the lungs is interfered with; and in a long catalogue of cutaneous disorders.

In your daily practice you will have to search for, and you will find, symptoms full of meaning in the amount, the qualities, and the character, of the customary discharges from the body; the urine, the fæces, the sweat, the mucous secretions of the air-passages, and the like.

Various and suggestive are the conditions and appearances presented by the tongue. A patient would think you careless, or ignorant of your craft, if you did not, at every visit, look at his tongue, as well as feel his pulse. Again, symptoms most significant and instructive may often be gathered from the attitude of a patient, from his gestures and gait, from the cast and play and expression of his features.

Let me once more remind you of the peculiar importance of accustoming yourselves to take notice of the symptoms comprised in the last two classes, and especially in the last class, that you may attain to a quick perception of them. Changes of sensible qualities speak for themselves, and speak the truth. They cannot deceive us, as the verbal statements of even conscientious patients respecting their uneasy feelings might. They direct us in the choice and order of our enquiries: nay, they frequently spare us the necessity of putting many questions; questions that might be irksome or fatiguing to our patients, or offensive to their natural delicacy, or even hurtful by letting them know our thoughts concerning their disorders. Of the changes in sensible qualities we judge by our own eyes, and ears, and fingers, and often by our noses also; and the change is sometimes, of itself, perfectly characteristic of the complaint.

Many more morbid phenomena, or symptoms, or tokens of disease, might have been mentioned; but I have said enough, I hope, to rouse your attention to the extent and the fertility of this field of study. When we next meet I shall begin to consider one of the special forms of disease to which all parts of the body are liable—a disease that meets us at every turn—I mean *inflammation*.

LECTURE IX.

Inflammation. Its Morbid and its Salutary Effects. Sketch of the Local and Constitutional Phenomena of Inflammation as it occurs in External Parts. Examination of the Symptoms of Inflammation: Redness; Swelling; Heat; Pain. State of the Capillary Blood-vessels and of the Blood in a part inflamed.

INFLAMMATION is a disease which must needs engage a large share of attention from both the surgeon and the physician. In nine cases out of ten the first question which either of them asks himself upon being summoned to a patient is, 'Have I to deal with inflammation here?' Inflammation is the constant subject of his treatment and his watchful care. All parts that are furnished with blood-vessels are liable to be affected by it, and it affects different parts very variously. Being more easily excited by many external causes, it is, therefore, more *common* also than any other special disease. A great majority of all the disorders to which the human frame is liable begin with inflammation, or end in inflammation, or are accompanied by inflammation during some part of their course, or resemble inflammation in their symptoms. Most of the faulty organic changes of different parts of the body recognise inflammation as their cause, or lead to it as their effect. The premature extinction of human life is more often owing to the agency, immediate or remote, of that process which we call inflammation, than to any other morbid condition whatsoever.

Again, inflammation is highly interesting, not only in its morbid phenomena and destructive consequences, but in its healing relations also. Wounds may, no doubt, be closed, and fractured bones may reunite without (and even sooner without than with) the intervention of any inflammatory process or product; but it is only under rare and very favourable circumstances that such injuries are actually so cured. In almost every instance, whether it be of a cut finger, of a deep sabre wound, or of a broken limb, it is the resulting inflammation which requires our care, and which furnishes the materials and the conditions of repair. It is through inflammation that parts adhere together when their adhesion is essential to the well-being and security of the individual—and that foreign or hurtful matters are conveyed safely out of the body. Does ulceration occur in the stomach or intestines, and threaten to penetrate through them? Inflammation will often forerun and provide against the evil—glue the endangered membrane to whatever surface may be next it—and so prevent that worse and universal inflammation of the peritoneum, and the almost certain death, which the escape of the contents of the alimentary canal into that serous bag would infallibly produce. The foot *mortifies*; is killed by injury or by exposure to cold:—inflammation, if it be not anticipated by the knife of the surgeon, will cut off the dead and useless part. An abscess forms in the liver—or a large calculus concretes within the gall-bladder: how is the pus or the stone to be got rid of? If they make their way to the external surface of the organ, as they always tend to do, they might enter the cavity of the abdomen, and excite fatal peritonitis. But a natural safeguard arises; partial inflammation precedes, and prepares for, the expulsion; the liver or the gall-bladder, as the case may be, becomes adherent to the walls of the abdomen on the one hand, or to the intestinal canal on the other; and then the surgeon may plunge his lancet into the collection of pus—or the abscess or the calculus may eat its own way safely out of the body—through the skin, or into the bowel. Inflammation, limited in extent and moderate in degree, becomes conservative by preventing inflammation more severe and more widely spread, which would be fatal. This is what I mean when I speak of the sanative properties of inflammation; and surely this process, which may save life or destroy it, deserves and demands our most careful study.

But inflammation has a still further and peculiar claim upon our attention. The salutary acts of restoration and prevention just adverted to, are such as *nature* originates and conducts. But we are ourselves able, in many instances, to control and direct the effects of inflammation—nay, we can produce it at our pleasure; and having produced it, we are able, in a great degree, to regulate its course. And for this reason it becomes in skilful hands an *instrument* of *cure*. This instrument the surgeon employs when, after letting out the water of a hydrocele, he wilfully excites inflammation of the tunica vaginalis, whereby its cavity is obliterated, and the re-accumulation of the fluid is rendered impossible. A fractured femur fails to reunite, or its fragments become connected by pliant and unserviceable callus. The surgeon, using a happy violence, provokes inflammation in the fractured part, and then a firm and bony union gives back to the limb its former strength and usefulness. It is by availing himself of the same agent that he is enabled to remedy many afflicting deformities :—to unite the cleft lip ; to knit up the fissured palate ; to rebuild the dilapidated nose. There is no other special disease which is thus at our command ; we cannot, if we would, create a tubercle or a cancer. For all these reasons inflammation possesses for us a very high degree of interest—for us and for everyone who would enquire, with any prospect of success, into either the pathology or the treatment of diseases.

Of the amount of our knowledge respecting the *intimate nature* of inflammation, I shall have occasion to say something by and by. We first become acquainted with inflammation in its symptoms, and as it displays itself externally. After we know what they are, it may be right, and it cannot but be interesting, to enquire how they come about. Now the symptoms which, when they exist together in an external or visible part, denote inflammation of that part, are four in number: redness—swelling—heat—pain ; *preternatural* redness and *preternatural* heat. These, from the earliest ages, have been recognised as the signals of outward inflammation. 'Notæ inflammationis (says Celsus) sunt quatuor—rubor et tumor cum calore et dolore.'

No definition, however, or general description, can be made to embrace all the forms in which inflammation presents itself. No useful account of it in the abstract can be given ; and therefore I shall first sketch the phenomena of inflammation under one of its simplest and most common forms ; and taking this as a type of the disease, proceed afterwards to trace its modifications and varieties, and to fill up the picture.

Let us suppose, then, that a healthy man receives some local mechanical injury—say that he falls against a window, and gets a fragment of glass embedded in the flesh of his arm. In a short time he begins to have pain in that part of the arm, and this is soon succeeded by redness, and increased heat, and swelling. The surface around the injured spot becomes of a bright red colour, which fades gradually from centre to circumference into the natural tint of the skin. The swelling augments, and centrally is firm and hard, and exquisitely tender. At some distance from the centre, although there is still swelling, the parts are softer and more yielding. In the seat of the redness and swelling the patient experiences a sense of heat, a burning pain ; the part is sensibly hotter than natural to the touch of a bystander; and if its actual temperature be measured by means of a thermometer, it will be found to exceed the temperature of the neighbouring surface. *The part is inflamed.* This is what is called phlegmonous inflammation. Φλεγμονη is a Greek word, and *inflammatio* is a Latin word, and they both mean the same thing, viz., a burning, or a flame. Phlegmonous inflammation is therefore, in truth, a tautological phrase. But custom has assigned a particular signification to the epithet phlegmonous;—it denotes that kind of violent inflammation in which the affected part seems all on fire; and chemistry teaches that, philosophically speaking, there is actual and excessive *combustion* going on in that part.

If the inflammation reach a certain degree of extent and of intensity, other signs of disorder present themselves at a distance from the injured spot. The patient usually at first feels chilly and feeble; but soon the temperature of the whole of the surface rises, the skin becomes everywhere hot and dry, the pulse more frequent and fuller and harder than is natural; lassitude comes on, with headache, and wandering pains in the limbs. The sufferer is unable or unwilling to exert himself, and finds that he is inapt for any mental effort; he cannot command his attention, gets confused and restless, and sleeps ill; he loses his appetite, his tongue becomes white, his mouth is parched, he is unusually thirsty, and the various secretions of his body are deranged and diminished.

This is *inflammatory fever.* This is an *indirect symptom* of inflammation, manifesting itself *through the medium of the system at large.* Various names have been given to this general derangement of the vascular and nervous systems: constitutional disturbance—sympathetic fever—symptomatic fever. It matters little what term is used, provided that we affix always the same meaning to it: but inasmuch as the word *fever*, in this and in other languages, is used to designate a specific class of diseases, it would perhaps be better to employ the term *pyrexia*, as Cullen and others have done, to denote that secondary febrile state which is associated with, or grows out of, primary local inflammation.

Now, what is the issue of this remarkable state of things? Why, it may end in one of two or three different ways. Supposing the piece of glass to have been extracted, and proper measures to have been taken for subduing the inflammation, or even supposing that no other measure has been adopted beyond removing the bit of glass, then it will often happen that the phenomena just described will gradually recede and disappear; the pain will abate, the redness fade, the swelling diminish, the heat decline, the pyrexia cease; until the part has at length regained its usual sensations and its natural appearance. When inflammation subsides in this way it is said to be *resolved*, to terminate by *resolution*: and this is its most favourable and desirable mode of terminating, whenever inflammation occurs as a morbid process.

But in many instances the inflammation does not thus subside. The irritant cause still remains in action—or the original intensity of the inflammation has been too great to admit of resolution—or the means proper to abate it have not been used—or have not succeeded. The symptoms already described continue, and are aggravated in degree; at length the swelling begins to assume a more projecting and pointed form, and the skin in its centre to look white: the mid part of the swelling, formerly so hard, becomes softer: the pain is of a throbbing kind; a pulsative sensation, keeping time with the beats of the heart, is experienced in the part, and often a feeling occurs as if something had given way within it: at last (if art do not interpose) the cuticle breaks, and a yellow cream-like fluid is poured forth, which we call pus; and upon its escape there generally ensues a considerable and speedy abatement of all the local symptoms of inflammation—of the pain, the heat, the redness, the swelling.

This is *suppuration*.

Meanwhile, especially if the suppuration be long continued, and the discharge of pus profuse, the character of the general febrile derangement undergoes a change. Slight but frequent shiverings, or feelings of chilliness, take place, and are followed by flushes of heat, which end in perspiration.

This is *hectic fever*.

If the injury have been still more serious, and the inflammation more intense, the part which it has invaded perishes through the violence of the disease: there is partial death. In that case the vivid red colour alters to a livid or purplish, or even a black, or greenish-black hue, the tension of the part exists no longer, the cuticle is elevated by a sanious fluid, the pain ceases, the part is devoid of all sensation—is dead, rotting, and putrid, being subject to chemical changes only—and exhales a peculiar and offensive odour.

This is *mortification*.

When the injury has been extensive, a corresponding and characteristic change is again observable in the constitutional disturbance. The patient grows more and more feeble; is apt to be delirious; has involuntary startings of the tendons of the voluntary muscles; his pulse is weak and very frequent; his tongue becomes dry, brown, tremulous; his lips are black with accumulated sordes; his countenance is shrunk, haggard, damp, and ghastly; his stools and his urine escape from him without his appearing to be conscious that they do so.

These are features which not seldom accompany an advanced stage of the disease named *typhus fever.*

Under more favourable circumstances the mortified or dead part, which is called a *slough,* separates from the living parts, and leaves a breach of surface. The separation is effected by a vital process which is termed *ulceration*; but which I need not now describe. The cavity thus formed fills gradually up, and heals in a particular way.

Taking the preceding statement as a groundwork, let us look back upon it, and trace its particulars a little more in full. The four characteristic signs of inflammation being redness, swelling, pain, and heat, it may be useful to examine more closely each of these symptoms in its turn.

Let us first consider the *redness*; which, as I have said already, must be *preternatural* in degree, for many parts of the body are, by nature, and in health, more or less red. This phenomenon depends upon the increased quantity of blood contained in the vessels of the part, for they may be emptied by pressure, and the red colour be thus made for a moment to disappear. In some instances, however, the colour is partly owing to the extravasation of a portion of the colouring matter of the blood into the affected texture; and the redness so produced does not vanish under pressure. There is more blood than usual in those vessels which naturally carry red blood, and that blood is fuller of red particles. Red blood enters too into vessels which in the healthy state are destined to receive and convey colourless fluids only, or which naturally admit *so few* of the red particles, that from their paucity, and the quickness of their motion, they cannot be seen. We are sure of this from what takes place in ophthalmia. At a later stage, when the process of inflammation has subsided and that of repair is in progress, the redness may be kept up by the presence of *newly* formed vessels which admit the colouring particles of the blood in visible numbers.

That the vessels which naturally circulate red blood undergo distension or enlargement in the inflamed part, there can be no doubt. John Hunter (whose treatise on Inflammation is a mine in which all succeeding writers have dug) excited inflammation in one of the ears of a rabbit, and then killed the animal. He next injected the head and ears from the aorta, so that the fluid used, passing through both carotids, was driven with equal force towards each ear. The arteries of the inflamed ear were enlarged one-third beyond their natural size, and arteries in it were injected which had no visible counter-parts in the sound ear. That the apparent increase in the number of blood-vessels is often owing to the entrance of red blood into tubes which already existed, but which did not previously admit the colouring matter, or did not admit it in sufficient quantity to be visible, is evident from the *rapidity* with which the redness may be produced in many textures: in the eye, for example, it may be effected in a few seconds; and many of the vessels which become suddenly apparent are evidently *continuations* of the trunks that could be seen before.

We now know something more—something of most highly interesting import—upon this subject, than was known when John Hunter lived. We know that the phenomena noticed by him in the inflamed ear of the rabbit, will follow the cutting off of the natural influence of the nervous system from the ear. If the sympathetic nerve, which sends branches to the ear, be divided in a living rabbit, the small vessels of the ear enlarge, the ear becomes fuller of blood, hot, red—blushes as Professor Huxley says—and finally it becomes actually inflamed. The muscular fibres encircling the minute arteries having lost their natural stimulus, pass from their standard condition of moderate contraction into that of relaxation, and the calibre of the vessels is enlarged.

We learn from all this to look, in every instance of inflammation, for the nervous element from which it may have sprung.

In the tint of the redness of inflammation there is much variety, depending on the kind and degree of the inflammation, and on the nature of the part affected. Sometimes the redness is bright and vivid, as if the part were full of arterial blood: this generally happens in the acuter forms and the earlier stages of inflammation. Sometimes the redness is dark, or livid, or purplish; more as if the part were gorged with venous blood: this occurs in some of the chronic and sluggish forms of inflammation, and it is often the case when there is a tendency to gangrene. Sometimes the redness is distinctly circumscribed, or presents itself in patches; sometimes it consists of innumerable minute red points; and sometimes it is diffused in a general blush over a large space.

The redness may, and often does, remain for some time after the inflammation has ceased.

Now, seeing that redness accompanies inflammation of the external parts, we presume that it exists also in internal inflammation: indeed, we may convince ourselves that it is so. If a portion of intestine be drawn out through a slit made into the belly of a living dog, and be suffered to remain exposed to the air, it will soon inflame; and inflaming, it grows red. We see also that internal parts are *left* red after death, which parts we have other reasons for knowing had been inflamed during life: and we infer that redness may have been present before death, although we should find none remaining when the corpse is examined. That when it has been owing to mere fulness of the natural blood-vessels, it may disappear with parting life we know, because the same thing happens externally, as in erysipelas and scarlet fever; but in such cases the inflammation has not risen to any great height.

It is proper to remark that as the absence of redness is no proof that there has not been inflammation, so its presence is no proof of the contrary. There are many kinds of redness, both within the body and on its surface, that have nothing to do with inflammation; yet some of these are very apt to be mistaken for traces of inflammation. I shall endeavour to instruct you how to avoid such a mistake, when we come to examine the morbid anatomy of particular forms of disease.

While inflammation actually exists, redness, of some shade or degree, is seldom absent, even though the other symptoms may be scarcely apparent. It is always slightest in those textures which, not being in themselves vascular, derive their nourishment by imbibition from the blood-vessels in their immediate neighbourhood.

The *swelling* of an inflamed part is also owing, in some measure, to the fulness and distension of its blood-vessels; yet no great amount of tumefaction can be attributed to this cause; and as much as does proceed from it occurs *early* in the disease. Some portion, and usually almost the whole, of the swelling, results from the presence of matters which the capillary vessels exude in excess into the affected textures, and from changes which the exudation undergoes and promotes. The matters thus emitted are of various kinds, but all of them are modifications of the same liquid, the blood. They are generally spoken of as 'effusions.' I mentioned, in describing the condition of the part inflamed, that the central portion of the swelling is, at first, hard and resisting, while at a distance from the centre the swelling is softer, and yields more readily when pressed by the point of the finger, and, sometimes, even pits a little under that pressure. Now the central hardness is to be ascribed to the exudation into the areolar texture of the part, of a fluid, which, transparent at first, soon becomes partially opaque and more consistent, and at last assumes a solid form. This is what is commonly called, in this country, coagulable lymph. The softer swelling at the circumference of the tumid parts proceeds from the passage of a thinner fluid, of serum, into the areolar tissue. Under very violent inflammation blood in substance may be poured out into the same parts. When the central portion of the swelling softens and becomes pointed, this part of the whole enlargement is owing to the presence of a quantity of pus. The different liquids that I have now been mentioning are of great importance, and play a conspicuous but diversified part in altering textures. Blood; serum; albuminous fluid or coagulable lymph; pus. They are called the *products* of inflammation. We are sure that inflammation has been at work if we meet with certain of these products. We are not sure there has been inflammation if we perceive mere redness:—we are not always sure if we find serum only:—we are not sure if we find blood alone:—we are tolerably certain if we discover pus; we are certain at least that there has been inflammation *somewhere*, though doubts have been started whether the pus is not sometimes conveyed from an inflamed part to other parts of the body. We are *quite* sure that there has been inflammation in a part if we find coagulable lymph in that part. This often remains during life as a monument of the inflammation, frequently it becomes organised, furnished with blood-vessels; and a great number of changes, some reparative, some morbid, depend upon its presence. I shall have to recur to these *products* of inflammation hereafter.

The degree of swelling in different cases depends partly on the intensity of the inflammation, partly on the nature and texture of the structures affected.

I scarcely need observe that swelling may exist without any inflammation. Herniæ, simple anasarcous enlargements, dislocations, will occur to you as every-day examples of swellings that have no necessary connection with inflammation.

On the other hand, inflammation may exist without any *appreciable* swelling. Inflammation of the sclerotic coat of the eye, for instance, may be present, without any swelling cognizable by our unaided senses.

The *pain* attending inflammation varies much in different cases, both in degree and in kind. It is differently felt, *cæteris paribus*, by different persons, according to their natural susceptibilities. It varies from very slight uneasiness to the utmost agony and torment. Parts which, when sound, are endowed with little or no capacity of sensation (as tendons, ligaments, cartilage, bone), become, often, exquisitely sensitive under inflammation. The organs of sense are variously affected in this respect. Thus the specific sensibilities of the mouth and nose are blunted by inflammation—those of the eye and ear are often rendered painfully acute. There are great diversities also in the kinds of pain. Sometimes it is of a dull aching character, as in toothache; sometimes it is a pricking, tingling, smarting sensation—this is the case in some forms of inflammation of the skin, as in erysipelas for example, and in herpes; sometimes it is sharp and piercing, as if the part were stabbed or cut with a knife—such is frequently the feeling in inflammation of the serous membranes, in pleurisy for instance; sometimes the pain is tensive or stretching; and sometimes there is scarcely any pain at all. This last chiefly happens in the mucous membranes and in the parenchymatous texture of organs. Very often the pain is a ‘ bulking ’ or throbbing pain—every beat of the heart makes itself felt in the tender part. The pain of inflammation results, no doubt, from the implication of the nerves in the diseased process. The stretching of the vessels and textures adds to the pain. Everybody who has been plagued by boils (and few escape them) has had proof of this: the pain is most harassing a short time before the ripening little tumour gives way, or is laid open by means of a scalpel; but this relief of the distension is followed at once by perfect ease and comfort. It is the same in common earache. Upon this principle may partly, I believe, be explained the differences in regard to pain, which occur in different structures under inflammation. Speaking generally, there is more pain felt in external inflammations, and in the inflammation of serous membranes, than in inflammation of the substance of the viscera, or of the mucous membranes: and it has been conjectured that this may be because, in the latter cases, the parts affected have fewer nerves of common sensation. But I do not think this explanation satisfactory. If it were well founded we should not have such exquisite pain in some of the textures already mentioned, which appear to be furnished with very few nerves of common sensation, and scarcely feel at all in their healthy state: tendons, ligaments, and cartilages, I mean. I think it will be found that most pain is felt in those parts which are least capable of yielding—in which the tension and pressure produced by the swelling, or by the tendency to swell, are the greatest. The substance of the liver and spleen, and of the viscera generally, is soft and extensible—the mucous membranes are spongy in their texture, and often attached to the subjacent parts in loose folds, and they allow of an accumulation of blood within them without becoming much stretched, or very tense. The investing serous and fibrous membranes are more tightly applied, and much less capable of yielding: and their inflammation is usually attended with severe pain. The same is true, for similar reasons, of the inflammatory affections of bones.

The pain that belongs to inflammation sometimes precedes any other apparent change. This is especially observable in regard to internal parts. Sometimes the pain is continued and uniform. Sometimes it is continued, but irregular in severity, having periods of great exasperation; sometimes again it is intermittent, and even periodic.

The question has often been mooted, whether in inflammation, the state of the blood-vessels is determined by that of the nerves, or the reverse. Mere nervous pains are known to be sometimes followed by congestion of the part in which they are felt. It may now be affirmed, too, that interruption of the healthy function of certain nerves is a sufficient and an actual cause of inflammation. It cannot, however, be doubted that the disordered condition of the blood-vessels, when produced, greatly augments the sensibility of the part. We may suppose that this depends, in some degree, on over-distension and stretching of the vessels and fibres, in some degree also on pressure made upon the nerves of sense by the swelling.

It is important to remark of the pain belonging to inflammation, that it is usually *aggravated by pressure*: frequently it is not felt at all, except when pressure is somehow made upon the affected part—intentionally by the physician—or accidentally, from the movements or position of the patient. This is *tenderness*.

And this is a point which requires a little further notice. I say the aggravation of the pain by pressure is an important circumstance, for it continually helps us to distinguish pain that is inflammatory from pain that is not inflammatory. Thus pain of the abdomen may result from colic, or spasm—from distension of the intestines by air, and a stretching of the textures and nerves belonging to them: and this sort of pain is mostly relievable by pressure; you will find patients lying with their bellies across the back of a chair for the sake of obtaining ease: but if the pain proceed, as it may, from inflammation of the peritoneum—oh! then the gentlest pressure, even that of the superincumbent bed-clothes, may cause intolerable anguish. The *suddenness* with which the pressure is made—and its being made on a *part* only of the suffering organ—these circumstances have much to do with the augmentation of the pain; and it is curious, and instructive too, to know that *gradual* pressure, applied *uniformly* to the *whole* organ or part under inflammation, is sometimes so far from enhancing the pain, that it lessens or removes it. Dr. Elliotson puts a very good case in illustration of this. ‘If (he says) you have a blister upon the sole of the foot, or at the ball of the great toe, and you rest gradually upon the part, the pain becomes mitigated, till at last it seems to be almost entirely removed; but the moment you take off the pressure, and raise the foot from the ground, you feel the part begin to throb—to throb with violent pain.’

This exemplifies what I said just now—that though a deranged condition of the nerves, whether painful or not, may, and certainly sometimes does, first lead to the vascular fulness—yet that same fulness, and the distension which it implies, will greatly increase the pain. In fact, the expulsion of the superfluous blood by means of well-regulated pressure is made the foundation of certain proposed methods of cure. This has been lately recommended in hernia humoralis, or swelled testicle—what is now more scientifically called orchitis. It gives one a sort of horror even to think of strong pressure being made on the healthy testicle—much more if it be rendered preternaturally sensitive by inflammation: yet, when properly managed, pressure is said (by Dr. Fricke, of Hamburgh, and others) not to increase the pain, but entirely to remove it, so that the patient can at once walk about the room; and ultimately the disease is thus cured. In the same way it has been proposed to cure erysipelas, and gout, and rheumatism. Without enquiring here into the general merits of this remedial expedient, I may remark that pressure, so employed as to benefit an inflamed part by supporting its strained and oppressed blood-vessels, must be steady, gentle, continued, and (above all) uniform pressure. All these conditions are strictly supplied in an apparatus devised by Dr. Arnott; whose *air-press* ought to be scarcely less useful to suffering humanity than his earlier contribution to the comfort of the sick—the *water-bed.*

It is sometimes necessary to recollect, especially when the existence of internal inflammation is suspected, that all expression of the sense of pain, and probably all sensation of pain, may be prevented or abolished by the presence of stupor or *coma.* So also, if the nervous connection between the inflamed part and the sensorium be cut off, no pain is felt. Limbs in a state of palsy are often (though not always) destitute of sensibility also; and inflammation readily occurs in them, but is then accompanied with no pain.

That *mere* pain does not constitute inflammation, must, I think, be plain to you. Spasmodic contractions of the muscles, stretching and tension of the tissues, a particular state of the nerves, and other conditions which do not imply inflammation, may, nevertheless, be attended with severe pain.

Increased *heat* is implied in the very term inflammation, and no doubt suggested it. External parts are obviously hotter when inflamed than when healthy, whether this be tested by the sensations of the patient, or by the touch of a by-stander. Since the time of John Hunter it has been held as an axiom that the heat of an inflamed part does not rise above the maximum heat of the blood in the central parts of the body. The natural heat of the blood is about 98° or 100°, but in fevers and inflammatory diseases it has been known to reach 107°, and the maximum heat of the blood in fever is probably the limit of the temperature as it exists in inflamed parts. The surface of the body, in its ordinary state, is not quite so warm as the internal parts, and the extremities are generally less warm than the trunk; so that the contrast between an inflamed and a healthy part, in respect of heat, is greater in the extremities than on the trunk. Thus if a blister be placed upon the chest, the heat of the part inflamed by its application will not exceed that of the neighbouring healthy surface by more than a degree or two; while a blister applied upon the leg may occasion a difference of five or six degrees. John Hunter took great pains to ascertain the degree of heat produced in inflammation. He excited inflammation in the cavity of the thorax of a dog, and in the vagina and rectum of an ass, and he could not find that the temperature of the parts thus inflamed ever exceeded that of the blood at the centre of the circulation. He did not neglect the opportunities that came before him of making similar observations on the human body. He had occasion to tap a patient in St. George's Hospital for hydrocele. As soon as he had let the fluid out, he introduced a thermometer through the puncture made by the trocar, and placed it in contact with the testicle. He found the temperature to be 92°. He repeated this experiment the next day, when inflammation had set in, and then the thermometer rose to 98¾°. So that here an increase of 6¾° had taken place in consequence of the inflammation; but even this, you see, did not go beyond the natural warmth of the blood.

The increase of heat depends upon the increased influx of arterial blood, and, therefore, of oxygen, into the part. Animal heat appears to be derived, in all cases, from the mutual action that takes place between oxygen and the elements of the tissues, their carbon and hydrogen; the tissues themselves undergoing meanwhile perpetual changes, which, in the natural condition of the body, belong and are necessary to health. In a part that is inflamed this combustion is, I say, excessive in amount; while unnatural metamorphoses occur in the affected tissues. It has, however, been made a question whether the increase of heat is brought into the inflamed part by the mere excess of blood which fills and flows through its vessels, or whether it is generated in the part itself by the rapid and unnatural changes which are there in progress. A series of interesting experiments contrived by Mr. Simon have satisfied him that an inflamed part is not simply a passive recipient of heat from its overfulness of blood, but that it is itself actually productive of heat. He found that the arterial blood supplied to an inflamed limb was less warm than the focus of inflammation; that the venous blood returning from an inflamed limb, though also less warm than the focus of inflammation, was warmer than the arterial blood, and warmer also than the corresponding current on the opposite side of the body.

From these experiments it may be inferred that in an inflamed part the increase of heat is due partly to the increased quantity of blood, but mainly to the local production of heat by the inflammatory process.

It is further presumable that in the inflammation of parts deeply seated in the interior of the body, the heat may become greater than the greatest natural heat of the blood.

We obtain also a glimpse of the way in which fever may grow out of local inflammation. The blood does not so much give heat to the part inflamed, as the part gives heat to the circulating blood.

Heat alone neither constitutes nor implies inflammation: for parts of the body may be made preternaturally hot by holding them before the fire, by friction, by exercise, while there is no inflammation.

I apprehend that increased heat is essential to inflammation in some stage or other of its progress, although there are cases in which the augmented temperature is not readily perceived or appreciated. Sometimes the increase of heat is very slight, and may be easily overlooked, there being, nevertheless, unequivocal inflammation; redness and swelling, which go slowly into suppuration. The heat is often concealed from the observation of the physician or the surgeon, by the situation of the part affected, and it escapes the notice of the sufferer, because the sensibility to heat is less generally diffused through the body than the susceptibility of common sensation. The heat of inflammation is usually less felt and less complained of by the patient than the pain. A vivid sensation of heat *is* pain.

We have seen, in this review of the symptoms of inflammation, how much they severally depend, the redness, the swelling, the heat, and the pain, upon the increased influx of blood into the part.

Taking the process of inflammation as a whole, can any reasonable explanation be given of it in the abstract?

We know that the various parts and textures of the animal body are in perpetual flux. Nothing of it continueth in one stay. This ceaseless change is, however, for the most part, not merely hidden from our view, but inappreciable by our senses. In the place of molecules that, in the vital actions and reactions are, instant by instant, becoming useless and effete, and are carried off to be ejected from the body, there are substituted, instant by instant, other molecules, precisely resembling those displaced when in their first perfection. The balance between the old material and the new is so exact and equal, and so constantly maintained, that the interchange escapes our notice, nay eludes our closest scrutiny. It is with our bodies as with a tranquil river. The smooth water looks as if it were always the same water, though it is always fleeting, and never the same for any two consecutive moments of time.

Now this natural, silent, continual transmutation of substance, this nice adjustment of loss and gain, this healthy equilibrium of form and quality, is disturbed and broken in every case of inflammation, which always implies, and consists in, an interruption of the normal stream of sustentative nutrition and renewal. The semblance of persistency of structure ceases. The breach of harmony becomes manifest to our senses by its results. What still goes on in the part is still destruction with growth, side by side, and commingled together. The same agencies as before are at work, but the workmanship is faulty. From some cause or other a physiological blunder is committed. On the one side an overgrowth of cell-germs multiply and sprout in prolific superabundance, and instead of undergoing transmutation into the proper texture of the part, confuse and supplant that proper texture; or pass, it may be, into abortive pus-cells: on the other the coarse remains of perishing tissues combine to encumber the inflamed space. There is a huddle of disorderly building materials collected and lying about, while the rubbish of demolition and dilapidation is not carted away.

You will find these conditions more amply described and unfolded in Mr. Simon's masterly essay on inflammation in the 'System of Surgery' edited by Mr. Holmes.

Let me read to you a few paragraphs from his pathological summary of the subject:—

'The phenomena of inflammation are modified phenomena of textural life. The modification is primarily one of quantity; the phenomena are in excess, but because of their excess, they tend to be unelaborated and crude. Change of material is striven for more rapidly than normal change can complete itself.'

'This excess but incompleteness of textural change shows itself anatomically in two concurrent signs; one belonging to the category of textural decay, the other to the category of textural renovation.'

'On the one hand there is *effete material unremoved*;—material disappropriated and brought to death quicker than it can impalpably melt away: hence "sloughs," and "desquamations," and "debris," and "softened" and "degenerated" tissue. On the other hand there are *nascent forms, unapplied*; forms which express a profuse but unconsummated textural growth;—forms which have resulted from intratextural germination, but have either perished before maturity, or have definitely ripened into mere abortions of texture: hence "irritative hypertrophy," and "degenerating endogenies," and "inflammation corpuscles," and "mucus-corpuscles," and "pus."'

In a former lecture I described to you the phenomena of active congestion as it may be seen through a microscope in the transparent web of a frog's foot; and I told you that such hyperæmia, though it did not necessarily pass into inflammation, was its unfailing antecedent, or initial step. Let us resume our inspection of the scene when the passage from the one to the other actually takes place.

I should have told you before, that various stimulant substances, mechanical or chemical, when applied to the web, will produce irregular disturbances in the circulation, which irregular disturbances you are not to confound with true congestion : in like manner you must avoid confounding them with the phenomena of *inflammation,* which are always preceded by those of true congestion. Kaltenbrunner found likewise, that (just as in congestion) a certain interval of time generally happened between the application of the exciting cause and the apparent development of the inflammation. Probably the blood-vessels are *contracted* during this interval. So I judge from experiments more lately made and reported by Mr. Paget. This accords with what we observe to be the case in respect of local injuries, and of those local internal inflammations that are apt to be produced by exposure to cold. There is a pause before the mischief lights up : or (to take the metaphor from the eggs of birds) there is a period during which the inflammation seems to be hatching, and it is called accordingly the period of *incubation.* Kaltenbrunner shows inflammation to be a regular process—as he had also shown congestion to be.

On looking then at the web, to which some violence had been done, he observed, after the first irregular disturbances were over, and when the period of incubation had elapsed—he found (I say) that an afflux of blood took place to the part about to be inflamed ; the velocity of the blood in the vessels was greatly accelerated ; the vessels themselves were distended and tense, and therefore disposed to tighten upon the blood they contained —the functions of the part, that is to say, the secretion and absorption of lymph, were interrupted ; the blood underwent an evident change—or it failed to undergo the proper changes : its red globules were crowded together, and the parenchyma of the web became tumefied. Now all this is just what I represented to you in a former lecture as constituting the state of the blood-vessels under *active congestion* ; which is just one step short of inflammation. The congestion now described increases, until, at length, this remarkable alteration happens : the minuter tubes lose their apparent tension, dilate, grow larger ; the red corpuscles fill those tubes more uniformly, approach their sides more nearly, in fact the liquor sanguinis diminishes. The blood thus altered begins to be here and there *delayed*; the direction of its motion becomes uncertain; it oscillates, as it were, to and fro in the capillaries, and at last stops altogether, the globules cohering in irregular masses, and thus *points of stagnation* are formed; and these points of stagnation, if the affection go on increasing, augment in size, and multiply in number. Around them, beyond their circumference, the circulation remains still very rapid, and the congestion persists. This is *inflammation*. Here it is, I apprehend, that the line must be drawn; viz., when the blood, ceasing to move with an accelerated stream through the dilated vessels, begins to pass slowly and more slowly, till it halts, oscillates, and finally becomes stagnant in some of the capillaries. At the same time the red corpuscles are very numerous and crowded. This, I say, is inflammation, of which the characteristic or pathognomonic feature is the formation of these *points of stagnation*, as a sequel of actual congestion.

Mr. Paget thus describes the general state of matters in and around a part that is inflamed:—'In few words, there is in the focus of severe inflammation, more or less of *stagnation* of blood; in and close around it there is *congestion*, i.e., fulness and slow movement of the blood; more distantly around there is *determination*, i.e., fulness and rapid movement of blood.' You will observe that he applies the phrase determination of blood to that condition which I have spoken of in these lectures as the commencement of active congestion.

He also bespeaks attention to the curious and important fact, that the stagnant or retarded blood of a part which is inflamed is not apt to coagulate. He had found it fluid after at least three days of complete stagnation.

I must not omit to tell you what Kaltenbrunner says about the direct absorption that takes place in the inflamed part. He found that the *colouring* matter, and the *adipous* matter, were thus taken away. The web of a frog's foot is speckled over with little stars of five rays, caused by a black pigment. The extremities of these rays gradually disappear until mere black points are left in the places of the stars. He says that he has been lucky enough to catch the exact moment when the blood, circulating rapidly in the canals, has detached a particle from one of the rays, and carried it into the torrent of the circulation. In the sound state, the mesenteric vessels of the rabbit are surrounded with much fat. When the mesentery is inflamed, the adipous cells soon empty themselves: a number of capillary canals are developed upon the walls of those cells, and it is probable that the fat is carried off by the blood circulating in these canals.

One early consequence of the stagnation of the blood, or of even its slow movement, is, that a portion of it transudes through the sides of the vessels containing it: the serum; or the liquor sanguinis; or the colouring matter; or even sometimes the blood itself breaks through, red corpuscles and all. The capillary network is ruptured. The effused serum remains, or is absorbed, as serum. The fibrin, when it has so transuded, concretes, and thus the interstices of tissues are filled up, and layers of coagulable or coagulated lymph are formed upon the surfaces of inflamed parts, constituting false membranes. Under certain circumstances, already adverted to, other or further changes take place. The yellow cream-like fluid called *pus* is formed; sometimes rapidly and in vast abundance, like a secretion. Pus may stream, almost, from certain of the mucous membranes, under inflammation. It has this analogy to the blood, that it consists of corpuscles diffused through a clear liquid (*liquor puris*) which both in its sensible and its chemical qualities appears to be identical with serum. The microscope, perfected by modern skill, is daily adding to, and rectifying, our previous knowledge, respecting the rudimental processes which occur in the living body, both in health and in disease. By its help we have learned that all, or most, of the varied animal tissues are formed through the intervention of minute closed sacs, or cells, having delicate membranous walls. These cells are themselves developed from pre-existing granules, germinal matters, nuclei, or cytoblasts; for such and so variously have they been named. Upon the completion of the cell, the nucleus sometimes disappears; but commonly it remains, a mere spot, upon the inner surface of the wall of its cell. Mr. Paget has shown the probability that this nucleus—which is not always developed into a cell—is 'the chief seat or source of formative, reproductive, and secretive power.' The red corpuscles of the blood are nucleated cells. Among them are also to be seen, floating in the liquor sanguinis, a small number of colourless corpuscles. Again, with the fibrinous matter poured out in inflammation, there are intermixed corpuscles, made visible by the microscope, called exudation cells. It seems probable that the nuclei of these last exude from the blood together with the fibrinous coagulable lymph. Whether they are identical, as some suppose, with the colourless globules of the blood; or, as others, with the nuclei of its red globules; or again, as others, with the corpuscles of the chyle;—these are questions which must be regarded as *adhuc sub judice.* The pus globule is also a nucleated cell; and it seems to be one of the forms of which the exudation cell is precursory.

The quantity of pus that is formed, and the rapidity of its formation, are in some cases of inflammation surprisingly great. By the repeated division and subdivision of germinal material the pus cells multiply profusely. But the pus cell itself is a barren and ultimate product, incapable of conversion by further development into any other structure, and useless for any purpose of repair; it can alter only by degeneration and decay. When pus proceeds from any surface communicating with the outward air, it is forthwith discharged from the body. Shut up in an abscess, it may work its way to a surface, and so find exit; or it may be let out by the surgeon's knife. If long retained, it may lose some or the whole of its fluid ingredients, dry up, shrink and wither, become perhaps more or less cretaceous; or the residual mass may gradually melt away under a process of fatty degeneration, and finally be removed completely from the body by absorption.

Much has been said and written heretofore about the *action,* and especially the increased action, of the blood-vessels as effecting the changes that characterise inflammation. But this was clearly a misapprehension. The heart, arteries, and veins constitute together a mere hydraulic apparatus, in which the physical laws of hydraulics operate exclusively. Their function is to carry the blood, and to regulate its distribution to the capillaries. Any action of which the small arteries are capable is a restraining action. No doubt, in inflammation, that action is suspended; their little muscles are unstrung. When, however, the blood arrives in the capillaries, which are passive tubes, it falls under the domination of new forces, chemical and vital, which act at right angles to the direction of the blood in those vessels, and govern the nutrition of the part. Here, therefore, it is that disease works its mischief, or obtains its cure.

It is another mistake to suppose, as some have done, that a greater quantity of blood than is natural passes through an inflamed part in a given time. It is quite true—and it is proper that you should be aware of it—that the arterial trunks leading to an inflamed part often pulsate with more than ordinary force, and, if opened, project a jet of blood further than they would naturally project it. It is true, also, that a venous trunk leading from an inflamed part will discharge blood faster and more copiously than a corresponding vein leading from a sound part. Mr. Lawrence declares that he has frequently tried this experiment, and always with similar results. Finding it necessary to bleed a patient whose hand and fore-arm were inflamed, he has directed a vein to be opened in both arms at the same moment; and he has ascertained that about three times more blood flowed, in a given time, from the vein of the inflamed limb than from that of the sound. But it scarcely follows from this that more blood circulates through the whole of the part actually inflamed: the activity of the circulation in the vessels that remain pervious, and are merely congested, around the focus of inflammation, is greatly increased, and more blood circulates through the *limb*: and yet the blood may be stagnant, or scarcely circulate at all, in the very part that is strictly and truly inflamed. However, the fact of this increased afflux of blood towards the parts concerned in the inflammatory process is an important one.

LECTURE X.

Inflammation continued. Increase of Fibrin in the Blood. Buffy Coat. Terminations or Events of Inflammation. Resolution; Delitescence; Metastasis. Effusion of Serum. Exudation of Coagulable Lymph, or Fibrin. Organisation of this Lymph. Suppuration. Ulceration.

In the last lecture, after giving a very general sketch of the phenomena of inflammation, I particularly considered its four characteristic symptoms—redness, swelling, heat, and pain. I endeavoured also to express some general idea of the process of inflammation in the abstract, and to describe the changes that take place in an inflamed part, as they are seen through a microscope.

Having learned what has been ascertained in this manner respecting the blood-vessels and the solid textures of the part inflamed, it is natural to enquire whether the blood itself manifests any corresponding deviations from its normal and healthy character.

There are, then, certain palpable changes which declare themselves in the blood in almost every case of inflammation sufficiently extensive or intense to give rise to pyrexia.

In the first place, the blood in inflammatory fever always contains a larger quantity of *fibrin* than the blood in health. Analysts have found twice, thrice, even ten times the normal amount. The augmentation begins with the inflammatory process, or presently after; increases with its increasing intensity; and diminishes as it abates. It has been made a question whether this increase of fibrin should be regarded as an enrichment or as a spoiling of the blood. Associated as it is with disease, we must conclude that the change is a debasement of quality. Mr. Simon holds that the increased proportion of fibrin 'represents actions of devitalisation and decay in some albuminous material;' but that 'whether this changing material be the inflamed texture gradually dissolving itself into the blood, or be the albumen of the fevered blood itself undergoing accelerated waste, cannot in the present state of knowledge be even approximately stated.'

If it be true, as it has been alleged, that in specific fevers the proportion of fibrin in the blood is diminished, we may infer that its augmentation depends upon the inflammation itself, and not upon the general febrile condition consequent upon the inflammation.

Secondly—allied with this increase of fibrin, and probably only another form of expression of the same thing, is a peculiar appearance presented by blood drawn from a vein during the existence of inflammation, and then suffered to coagulate.

A portion of the fibrin at the upper surface of the coagulum parts with its colouring matter; so that upon the deep red clot there is to be seen a layer of a yellowish, or sometimes of a bluish white colour, varying in thickness from a line or two to perhaps three-fourths of an inch. This uppermost whitish layer of the coagulum is called in this country the *buffy coat* of the blood. Sometimes the surface of the buffy coat is flat and wide; but often it is concave and contracted: it is hollowed out into a cup-like form, and its diameter is less than the diameter of the lower portion of the clot. Accordingly the blood is said, in these circumstances, to be both buffed and cupped. The formation of this buffy coat appears to be favoured by many circumstances which have nothing to do with the disease under which the person may be labouring; such as the size of the aperture in the vein, the manner in which the blood flows, the form and size of the vessel that receives it: but it does not occur at all except in certain conditions of the system; and it belongs so especially to the state of *inflammation*, that blood having the buffy coat upon it is often spoken of as *inflammatory blood*, or, with less propriety, as *inflamed blood.* Both these expressions indeed are incorrect, for inflammation sometimes exists without buffy blood; and buffy blood sometimes occurs without inflammation.

When venæsection was more in fashion than it has lately been, this buffy coat of the blood was made much of, firstly, as an indication that the disease under view was really inflammatory; as a diagnostic sign, therefore, in cases otherwise ambiguous: and, secondly and especially, as a lawful warrant for bloodletting as a remedy, or for its repetition if it had already been done. It is not, however, peculiar to inflammation. The blood of pregnant women, and of persons who are simply plethoric, has often been found to show the buffy coat. Neither could it be taken as a necessary measure of the danger of the disease. The blood drawn in acute rheumatism is always very much buffed and cupped, yet so long as that disease is confined to the joints, it is quite free from danger to life. Nay, it is even affirmed, by trustworthy writers, that in pure anæmia the crassamentum, though small from the paucity of red particles and its little fibrin, has the same appearance. This I can neither confirm nor confute by my own experience; for even in the times of bloodletting we did not bleed anæmic patients unless they were believed to labour under some local inflammation.

Take notice of the analogy that subsists between this buffy coat and the coagulable lymph poured out in inflammation, either into the texture of the part, or (as I shall show you more particularly by and by) upon its surface, forming what are called false membranes. Both in appearance, and in chemical composition, the two seem to be identical: there is in fact no doubt of their being actually the same substance; the separation in the one case taking place from the blood while contained in its proper vessels; in the other case from the blood after it has been removed from the body.

There has been a great deal of speculation among pathologists as to the cause of this buffy coat. From its situation it is plain that gravity has something to do with its formation: that the red particles, leaving the colourless fibrin before it coagulates, sink downwards by their own weight. But though the *subsidence* of the red particles is occasioned by their greater specific gravity, their *separation from the fibrin* is not to be explained upon that principle alone. If it were, then it would follow that the slower the coagulation of the blood, the more time would there be for the sinking of the red particles, and the thicker and more decided would be the buffy crust. And it used to be supposed that this was the true explanation of the phenomenon. Careful observations, however, have shown that the formation of the buffy coat often takes place when the coagulation of the blood is unusually rapid. Dr. Davy and M. Gendrin both state, as the result of much attention to the subject, that the coagulation of blood drawn from a vein during inflammation begins sooner, and is more quickly completed than that of healthy blood. But certain observations made and published by Dr. Stokes have settled this question. He noted the appearance of the blood in twenty-seven cases. In fifteen of these the buffy coat presented itself; in twelve it did not. Now in three of these twelve, coagulation of the blood did not begin till from twenty to forty minutes after it was drawn; and in four others there was no coagulation for eight minutes. So that there was plenty of time for the red particles to have left the fibrin, and subsided;

but they did not do so. On the other hand, in twelve out of the fifteen cases in which the blood *was* buffed, the coagulation took place in five minutes; and in the remaining three it was delayed only fourteen minutes.

The slowness of the coagulation, therefore, although it may and doubtless does *favour* the subsidence of the red particles when they have a tendency to subside, cannot be regarded as the sole cause of the buffy coat. The red particles very soon begin to subside when they subside at all. You may tell, immediately after it has been drawn, and prior to any coagulation, that blood is about to buff, by a peculiar bluish hue on its surface. A German writer, Schroeder Van der Kolk, has stated observations to the same purpose, showing that in the blood abstracted by venæsection during inflammation there is an unusual disposition to a separation of the fibrin from the red particles: a sort of *repulsion* between them. This separation takes place in mere films of blood, so thin as not to permit a buffy stratum to lie above a red stratum. The fibrin and the red particles then separate from each other laterally by horizontal movements, and the films acquire a speckled or mottled appearance, quite as characteristic of the state of the blood as the buffy coat itself.

One cause of the rapid subsidence of the red corpuscles in blood drawn during the presence of inflammation, is the tendency then especially manifested by these disk-like bodies, as noted by Hewson, Mr. Wharton Jones, and others, to cohere permanently together, by their flat surfaces, in little cylindrical columns, like rolls of coin. Thus aggregated into masses they would sink more readily through the liquid plasma of the blood than as separate corpuscles. Of this curious tendency no satisfactory explanation has yet been given.

While the clustered corpuscles thus descend, the thickness of the buffy coat is increased by the white corpuscles, which remain separate, and having a less specific gravity, float upwards.

It is a curious fact that blood drawn by leeches never exhibits the buffy coat. It seldom appears (yet I have seen it) upon blood that has been removed by means of cupping glasses.

Arterial blood is liable to the buffy coat. I have myself twice at least noticed it upon blood drawn from the temporal artery. One of the patients was violently maniacal when the blood was taken. The other was labouring under acute inflammation of the membranes of the spinal cord, of which inflammation he died.

Blood is more likely to buff, *cæteris paribus*, when it is made to flow in a full stream, and when it is received in a deep and narrow vessel.

The buffy coat seldom appears on blood drawn at the very outset of inflammation; generally a day or two elapses before it shows itself. This is just what we might expect if it be true, as it is probable, that this unnatural property of the blood, and the increase in its fibrin, are acquired only in the course of its passage through the vessels of, or adjacent to, the inflamed part.

The condition of the blood, you see, is sensibly modified by the occurrence of serious local inflammation in the body. Conversely, the aspect and character of the local inflammation are as surely influenced and modified by the pre-existing and co-existing qualities of the blood. Unhealthy blood produces what may fairly be called unhealthiness of the inflammatory process. Of this you may any day convince yourselves by a visit to the surgical wards of the hospital. Ulcers, or open sores, of like origin and kind, differ remarkably according to the state of the patient's general health—whether he is labouring under a specific fever, or some chronic disorder, or some constitutional disturbance, on the one hand, or whether, on the other, he is, the ulcer excepted, in sound health. It is John Hunter's observation that 'an inflammation produced in any part by violence will always be as the constitution is. If the man has fever, a cut will partake of the disease, and the inflammation will be erysipelatous, or so on.' Even in the same person a sore—an unhealed stump after amputation, for example—will vary in its appearance from day to day under slight external influences; slight, but sufficient to modify temporarily the condition of the circulating blood. Dr. William Addison dwells upon this in his suggestive pamphlet 'On the Co-existence of two Species of Inflammation.' He observes that a discharging issue (which I shall have to tell you hereafter is one of our remedial inflictions) may serve as a kind of bodily barometer. 'On some days, if the patient has been imprudent in his diet, or otherwise partaking of unwholesome things, the sore becomes painful, and the surrounding edges are red and angry. There are changes in the appearance of the granulations, and in the qualities of the pus. Over many parts of the sore, granulations are fading away into ulcerations, and the purulent discharge assumes morbid characters; but a more careful regimen, a brisk purge, and appropriate medicines, soon bring matters to the former state.'

You may expect, then, to find, and you will find, that the march of inflammation differs considerably according as it may occur in healthy persons, in persons stamped by certain constitutional peculiarities or diatheses, in persons affected with some chronic disease, and in persons suffering under fevers and whose blood is therefore poisoned or impure.

Some pathologists enumerate several *terminations* of inflammation. Others quarrel with that word, as inappropriate: alleging, with much truth, that the inflammation does not necessarily cease or terminate whenever these so-called 'terminations' happen. Some of them are in fact 'co-existent states, or successive stages in the progress of the same inflammatory disease.' It has been proposed to speak rather of the *local effects* of inflammation: but even this phrase is not free from objection, for sometimes (though rarely) there are no local effects produced, beyond the four symptoms which characterise the inflammation itself. I think the *events of inflammation* is an expression not open to similar cavil. I have no ambition to introduce new modes of speech, unless when those already in use are inexact or inapplicable. It is enough if you clearly comprehend the meaning of the terms I employ. Among the events of inflammation I include only the *local* changes observed in its course. To those which are constitutional I must afterwards revert.

You will recollect that I did allude, in the last lecture, though in a very brief manner, to these local events of inflammation. Their frequency and importance render it necessary that we should consider them somewhat more particularly.

One of these events is the simple subsidence or *resolution* of the inflammation: this may strictly be called a *termination* also. The congestion of the blood-vessels increases till the blood stagnates in some of the capillary canals towards the centre of the affected part, which is then said to be *inflamed*; but the disease goes no further; there is no escape of the blood, nor of any part of the blood, nor of any of the constituents of the blood, beyond its natural channels; or, at any rate, there is no *sensible* evacuation into the inflamed tissue, or next to none. The inflammation begins to recede; the stagnant but still fluid blood is again set in motion; if there have been some slight effusion, it is reabsorbed; the rapidity of the circulation in the surrounding vessels diminishes; and the part returns, in all respects, to its former condition and integrity. This may be considered the spontaneous cure of inflammation; and to this event there seems to be always a natural tendency. It may be promoted, sometimes, by art.

When the process of resolution is unusually *sudden* and *rapid* (as it occasionally is, the well-marked phenomena of inflammation completely disappearing in a few hours), it is called by our neighbours the French, *delitescence.* And when the symptoms of inflammation thus suddenly desert one part, and show themselves immediately afterwards in another (as not unfrequently happens in acute rheumatism with respect to the joints, and between the parotid gland and the testicle or mamma in the mumps), *metastasis* is said to take place.

This transference, as it were, of morbid action, from one part to another, is a very curious circumstance. It is one which we sometimes endeavour to imitate. We excite inflammation upon the surface, where we know its effects will be of comparatively little consequence, in the hope of *diverting* it from some internal organ in which it threatens to work serious or even fatal changes. We follow the same principle perhaps when we apply purgative medicines to the mucous membrane of the alimentary canal. To denote this mode of cure, by stimulating distant parts, the terms *counter-irritation*, *derivation*, and *revulsion*, are employed.

Most commonly, even under moderate inflammation, *some* amount of exudation or effusion takes place into the texture or from the surface of the part.

The first effect or event of that kind which we notice, is the pouring out or *effusion* of *serous* liquid. The liquid is so like the serum of the blood, that it is called serosity or serous liquid. In most cases, however, it is something more than this; it is in reality the liquor sanguinis, serum holding more or less fibrin in solution, and charged with a larger amount of chloride of sodium, and of phosphates, than is present in the serum of the blood in health. Mr. Paget teaches that an effusion of serum alone is an uncommon effect of inflammation, and that it is generally characteristic of only the lowest degrees of that process.

This effusion of serum, or of liquor sanguinis, as it is one of the earliest events of inflammation, so it is often its most important event; producing, mechanically, new symptoms, and giving rise to conditions of the most perilous kind. The quantity of serous fluid poured out in a short time is often immense. One of the pleuræ may be thus filled in a few hours, and the whole of one lung strongly compressed, and the respiratory apparatus reduced to one-half of its customary efficiency. And if inflammation and copious effusion should take place on both sides of the chest at once—if *double pleurisy* with this event should occur, as it sometimes does—the patient must presently perish by apnœa, unless his condition is recognised, and free vent is given to the fluid. More than once or twice I have seen persons snatched from the brink of suffocation by what is called *tapping* the chest. Fatal coma is no uncommon result of the effusion of serosity, as an event of inflammation, into the ventricles of the brain.

Even in the areolar tissue, where it is properly enough called œdema, a very trifling amount of this serous effusion may be sufficient to destroy life: when, for instance, it takes place into the submucous areolar tissue of the glottis, closing up by its presence and pressure that little chink, the rima glottidis, and suffocating the patient after another fashion. Here also art may come to the rescue: an *artificial* chink or hole is made for the entrance and exit of air, below that part of the larynx in which the disease is situated, and the patient is delivered from imminent death. I have had some cases under my own care, and have seen many others, in which life was so preserved. I allude to such cases now, merely to convince you of the importance of attending to this event of inflammation, and of studying the indications of its existence.

Sometimes some of the small vessels give way, and *hæmorrhage* into the part becomes an event of inflammation. Some slight degree of this occurs probably in most cases; and we frequently find that the colouring matter of the blood is mixed with the other effusions, giving to the serous liquid a deep tinge of red.

I hinted before, that we must not infer inflammation from the presence of serous effusion *alone*. Serum will exude, I believe, from loaded veins, even after death; but this never can be much in amount. It is certain that dropsical effusions may be, and very often are, the result of congestion of a purely mechanical kind.

A third *event* of inflammation is the effusion of what is called *coagulable lymph*, which, as I explained to you before, appears to be nothing else than the fibrin separated from the other constituents of the blood, and concreted. It is poured forth, at first, in a state of solution, or in a soft semi-fluid condition, and mixed with, or dissolved in, more or less serosity; but the fluider parts of the effusion are either soon re-absorbed, or soon separate themselves from the fibrin, which becomes firmer, and at length solid. The hard central portion of a phlegmon, in its earlier stages, owes its hardness to the presence of coagulable lymph in the natural interstices of the inflamed part; and a similar interstitial deposit of the same substance is common in various parts of the body, as a result or concomitant of inflammation. What is called hepatization of the lung is one instance: the spongy texture of the lung is blocked up and solidified by this lymph. In certain cases of erysipelas, as well as in phlegmonous inflammation, the subcutaneous areolar tissue is rendered dense and hard in the same way. The white opaque spots which are often noticeable upon the cornea are produced by lymph interposed between the layers of that naturally transparent structure. But the most striking examples of effused coagulable lymph are to be seen upon the surfaces of inflamed membranes. The lymph forms a web or layer which by degrees assumes, itself, a membranous appearance; and is accordingly called by morbid anatomists a false or an adventitious membrane. Sometimes several layers of this kind are spread one over another, forming adventitious membranes of great thickness. When coagulable lymph is thus poured out between membranes that are habitually in contact with each other, it often causes them to cohere; just as two leaves of a book may be made to stick together by a layer of paste put between them. This result is very common indeed with serous membranes, especially with the pleuræ, the pericardium, and the peritoneum. Lymph is sometimes also poured forth, under violent inflammation, from mucous surfaces. In diphtheria the soft palate and fauces—in croup the interior of the trachea—suffer inflammation, and a substance exudes which assumes a membranous form, and adheres more or less firmly to the inflamed surface, or is ejected, in ragged fragments, by efforts of hawking or of coughing. A like effusion takes place occasionally from the mucous lining of the alimentary canal, and is expelled, with the other contents of the bowels, in shreds, or in tubular films, which are, in fact, casts of the interior of the gut. It has been made a question whether the false membranes in these cases are really composed of fibrin. I may discuss that question hereafter. Similar casts form within the vagina, and are moulded to the exact shape of its cavity, and marked with indentations that correspond to its rugæ; and these casts are at length separated and extruded. They are not very common; but I show you one which came from the genital organs of a young woman who was a patient of mine in the Middlesex Hospital. I had regarded it as a cast of the uterine cavity, but Professor Farre has informed me that it exactly represents the natural epithelial lining of the vagina, and that such casts are occasionally shed in certain forms of dysmenorrhœa. These therefore are not true examples of membrane-like lymph. You may see lymph deposited like beads, upon the anterior surface of the iris under inflammation; or glueing its posterior surface to the crystalline lens behind it, and rendering the pupil irregular, and sometimes immovable, or even sealing up that aperture. The internal surface of the heart, and especially its valves, are often studded with portions of lymph much resembling warts. When the opposite sides of an artery are brought together by a ligature, they inflame, and become united by the same medium. Coagulable lymph is effused, in the course of a few hours, upon the edges of a cut wound, and they adhere, under favourable circumstances, when placed in mutual apposition. This surgeons call union *by the first intention*; and the inflammation which is accompanied by this kind of exudation of lymph, or fibrin, is called *adhesive* inflammation; or the *adhesive stage* of inflammation.

It is seldom, if ever, that coagulable lymph *alone* is thus poured forth. Sometimes it is tinged with the colouring matter of the blood. Oftener it is mingled with, or rather it is at first dissolved in, a large quantity of serous fluid. In other words, the plasma of the blood exudes, and afterwards separates into fibrin and serum. When this happens in serous bags—as in the pericardium or the pleura—the thinner fluid may keep the opposite membranes apart; and so prevent for some time, or entirely, their agglutination. Sometimes the agglutination is partial, and the uniting portions of lymph are stretched out, by the distending effect of the fluid effusion, or by the natural movements of the parts, into bridles or strips of adhesion.

I must call upon you to notice, in passing, that although this event of inflammation may sometimes perhaps have a detrimental or destructive consequence, yet that in a vast majority of instances it is distinctly a salutary and conservative event. Vision may, no doubt, be destroyed by a plug of lymph which shuts up the pupil of the eye. A portion of intestine may become strangled by a band of adhesion. Of this, which is a mere accident of the adhesion, I have seen several fatal examples. The closure of the trachea by the membrane of croup is scarcely, perhaps, a fair case in point. There are, at any rate, but few exceptions to the rule, that the effusion of coagulable lymph proves beneficial by preventing some worse event of inflammation. It is better that suppurative inflammation of the areolar tissue should be limited and hemmed in by a barrier of lymph, than that it should extensively diffuse itself. It is better that the bag surrounding the heart, when it happens to be inflamed, should become adherent to that organ, than that the inflammation should run on into suppuration, and fill the pericardium, and oppress the heart, with pus. In the one case, life may continue for several years; in the other, it seldom lasts many days. It is clearly more desirable, and more consistent with the safety and comfort of the patient, that his lungs should be fastened to his ribs, than that they should be compressed and flattened against his spinal column. I shall have occasion so frequently to speak of this protecting and reparative tendency of adhesive inflammation, that I do no more than point it out to you at present.

When lymph has been effused upon an inflamed surface, it very readily becomes vascular and *organised.* Red streaks begin to be visible in it. These are incipient blood-vessels, which may soon be seen to be continuous with the blood-vessels of the inflamed part. The plastic lymph is fashioned, by outgrowth from adjacent vessels, into a definite structure, and made a living constituent portion of the body. It is, in truth, this remarkable *plastic* property belonging to the effused lymph, this aptitude for being organised, which invests the adhesive inflammation with its guardian and reparative character. None of the other fluids poured out under inflammation are capable of this change. It is in this way that the lips of recent wounds, and the surfaces of inflamed membranes in contact with each other, are permanently stitched together (if I may use so homely a metaphor), by living vascular threads. By this needlework of nature, parts recently severed from the body may sometimes be replaced, or even transferred and affixed to other situations, as in the Talicotian operation, whereby a new nose is engrafted in the place of that which had been lost. It is thus that ulcers fill up: successive layers of lymph exude, and are in succession attached to the ulcerated surface, and incorporated by this organising process, until the breach of texture is repaired. Lymph thus organised comes at last to resemble areolar tissue, more or less condensed; or it tends 'to assume, sooner or later, the characters of the tissue in or near which it is seated, or in place of which it is formed.'

The length of time required for the exudation of coagulable lymph in inflammation, and for its subsequent organisation, is variable under different circumstances. It is often effused very early. Dr. John Thomson found a distinct layer of it covering wounds he had made in an animal, in less than four hours after they were inflicted. It seems probable that vascular organisation of the effused lymph may be effected within the space of a few days. Sometimes, on the other hand, two or three weeks may elapse before any such organisation is observable. Mr. Paget affirms that its occurrence implies a cessation of the *inflammatory* process.

Several conditions seem necessary to ensure this adhesive form, or adhesive stage, of inflammation. The inflammation must reach a certain degree of intensity, or no lymph will be effused; it must not go beyond a certain degree of intensity, or the next *event* I have to mention, the formation of pus, will interfere with the adhesive process. We learn also from what takes place in recent wounds, that seclusion from the air, and the absence of all other causes of irritation, help towards promoting adhesion, or union by the first intention.

The formation of *pus—suppuration*—is a fourth *event of inflammation*, to which brief allusion has already been made.

Pus is an opaque, smooth, yellowish fluid, of the consistence of cream, and having little or no smell. I speak now of well-formed, or what is called good, or healthy pus; what the old writers spoke of as *pus laudabile*. This has been thought an absurd epithet; but it serves as well as any other to express what was meant, viz., that kind of pus which accompanies benign forms of inflammation, and indicates that all is going on regularly, and promises a fortunate ending; pus, in short, the appearance of which was *to be commended*. It is certainly not more absurd than the term *healthy* pus. This pus laudabile was described as being *album, læve, et æquale*—light-coloured, smooth, and homogeneous. This description of good pus has descended from the time of Hippocrates, who says, Τὸ δὲ πύον, ἄριστον λευκόν τε εἶναι, καὶ ὁμαλὸν, καὶ λεῖον, καὶ ὡς ἥκιστα δυσῶδες. It consists, as I told you before, of yellowish globules, diffused through a serous fluid. The globules are shown, by the microscope, to be nucleated cells: and they are believed to be developed from germs which pre-exist in the effused plasma of the blood.

In order to explain the modern doctrine on this subject, it is necessary to go back a little.

The so-called serous effusions which take place under inflammation are some of them quite clear, some of them turbid. The clear effusion, while it remains shut up within the body, may remain clear for a long time; but being withdrawn, its fibrin presently coagulates, or lymph is deposited. I have seen several pints of transparent liquid removed by tapping the cavity of the chest, after having been confined there for many days; and immediately upon cooling, it separated into two distinct portions—the one limpid and thin, the other of the consistence of jelly, and distinctly fibrous when dried by pressure. Commonly, however, in pleurisy with liquid effusion, lymph is smeared over the surfaces of the pulmonary and costal pleuræ, which are only prevented from cohering by the intervening serum.

Now, of this inflammatory lymph there are described by Mr. Paget two varieties—the *fibrinous*, and the *corpuscular*.

The fibrinous variety is that of which I have already spoken as coagulable lymph, as constituting adhesions and false membranes, and as being capable of organisation.

The corpuscular variety does not thus concrete or coagulate; but corpuscles (exudation corpuscles or cells they are called) form, and float free in the liquid: neither is this variety susceptible of being organised, but the corpuscles ripen into pus globules, or are broken up and disintegrated, and thus render the liquid with which they are mixed turbid, or whey-like.

In most instances of inflammatory exudation, perhaps of all, this fibrin and these corpuscles exist together, but in very varying proportions; and (to use Mr. Paget's language) 'the preponderance of fibrin in the lymph is generally characteristic of the *adhesive* inflammation: the preponderance of corpuscles, or their sole existence in the liquid, is the general feature of the *suppurative* inflammation.' This accords with Mr. Simon's statement that all the inflammatory effusions, when scrutinised through a microscope, disclose organic living forms, few or many. In the thin clear effusions they are scarce; in the more turbid they teem.

The occurrence, in a given case, of one or of the other of these forms of inflammation, the adhesive or the suppurative, appears to depend partly upon the state of the patient's general health, the adhesive form prevailing in those who were previously sound and strong, the suppurative in those who were weak and cachectic; partly, as I shall show you by-and-by, upon the particular textures affected; and partly, as I have already stated, upon the degree of intensity of the inflammatory process itself.

Even the preventing or the allowing the access of air to the surface of a recent cut will make all the difference between adhesion and suppuration. Upon this principle are founded the modern and felicitous operations of sub-cutaneous surgery. And the same influence of the air in promoting the suppurative process instead of the adhesive is remarkably seen in various other cases. In simple pleurisy—from exposure to cold—we seldom have any liquids effused, except coagulable lymph and serous fluid. But if the inflammation have been caused by a punctured wound from without, or by laceration of the *pulmonary* pleura by the sharp end of a fractured rib, or by perforation of the pulmonary pleura from the extension of a vomica in the lung—in all which cases air finds its way to the inflamed membrane—then true *empyema* results—pus is formed. So also in pneumonia: at first the inflamed lung is rendered solid by the effusion of coagulable lymph into the air-cells; but if the inflammation persist, the next thing that happens is what is called by Laennec *gray* hepatisation—a puriform infiltration takes the place of the previous lymph. The same principle is exemplified in the case of the urethra; inflammation of the *free* surface of its mucous membrane leads rapidly to the formation of pus; inflammation of its *attached* surface occasions the pouring out of fibrinous lymph, which produces stricture. And in general I think it may be said of surfaces that are open to the air, of tegumentary membranes, that either pus is formed upon them under inflammation, without any previous effusion of plastic lymph, or the lymph is slight in amount, and transient in duration, and presently superseded by a puriform discharge. We have every day examples of this, in inflammation of the conjunctiva, of the bronchi, of the bladder. Perhaps it is in this principle that we may find an explanation of the fact, that whereas in the inflammation of the areolar tissue, of glandular organs, or of the parenchyma of the viscera generally, the pus which forms is collected into a focus; circumscribed abscess in the substance of the *lung*, from common inflammation, such as we are now considering, is very rare indeed. This is a point which will of course come under our consideration again.

There is, however, manifestly a close connection in many cases between the effusion of coagulable lymph and the production of pus; although the progress and effects of adhesion and suppuration are very different. When suppuration takes place, the pain belonging to the inflammation usually abates, or ceases, except when the pus is imprisoned so as to keep up the pre-existing tension. Certain remarkable constitutional phenomena also declare themselves, which I shall notice again hereafter.

The effusion is longer continued in the case of suppuration; and the quantity of pus is more copious generally than of fibrinous lymph, especially as respects the serous and tegumentary membranes. When pus is diffused through the natural textures, it tends to soften and separate them—to break them down; whereas the direct effect of the deposition of coagulable lymph in the same parts is to consolidate and harden. Again, in some instances the final cause of the formation of pus would appear to be the ultimate elimination of coagulable lymph previously deposited.

When pus has been poured forth into one of the natural cavities of the body, there is said to be purulent *effusion.* When it is contained in a closed cavity which is not natural, but formed by lymph and condensed areolar tissue, the collection of pus is called an *abscess.* It may also proceed from a free surface of the body—as the skin, or a mucous membrane, or a superficial sore.

The time required for the formation of pus is extremely variable. Suppuration sometimes very quickly follows the commencement of the inflammation; within a few hours, as in gonorrhœa. Sometimes it is postponed to a very distant period, even for weeks.

The duration of the suppurative process is also uncertain, and seems to have no fixed relation to the intensity of the inflammation by which it has been preceded or accompanied.

There are various modifications of pus; and its sensible qualities are liable to rapid alteration by various circumstances. Sometimes the globules are few in proportion to the more watery part; and then the pus is said to be *ichorous.* It is *sanious* when some of the colouring matter of the blood is poured out with it. It is sometimes viscid and slimy, from being mixed with mucus, or with an alkali; or flaky and curdled, which is common in scrofulous persons. Sometimes, also, instead of being, when cold, inodorous, it is horribly fetid. All abscesses that form in or about the alimentary canal are apt to contain pus of an offensive smell; as those which occur in the tonsils, or near the rectum. A patient of mine in the hospital, had in his epigastrium a fluctuating tumour, which Mr. Arnott opened. There came out the collapsed bags of two or three hydatids, and a quantity of stinking pus. The liver, no doubt, was the seat of suppuration in this case—and perhaps the stench might be owing to the death and decomposition of the hydatids.

Great pains were formerly taken in searching to discover some sure criterion between pus and mucus. Healthy pus and healthy mucus are so totally unlike each other, that they never can be confounded together. But sometimes we can scarcely say whether we are looking at mucus so altered as to resemble pus, puriform mucus—or at genuine, though not perhaps praiseworthy, pus. The microscope has superseded that quest. Having once had pus-globules shown you through its magnifying power, you can never fail to recognise their presence in any fluid, by the same help, afterwards.

In suppuration, some of the products of inflammation degenerate. The affected tissues themselves degenerate in what may be considered a *fifth event* of *inflammation*, namely, *ulceration*. You may remember my telling you that Kaltenbrunner observed the process of absorption in the inflamed tissues which he examined by the help of the microscope: how the stellated spots gradually vanished from the web of a frog's foot, and the fat from the mesentery of the rabbit.

Independently of these microscopical observations, it is quite evident that absorption goes on, often very actively, during the continuance of inflammation. The effused fluids, or products of inflammation, the serum, the lymph, the pus, are partly taken up again: and not only are these products of inflammation liable to be so removed, but the original textures of the body are carried off by absorption. We cannot have a better proof of this than the progress made by an abscess towards the nearest surface at which the pus it contains may be discharged; the intervening textures are gradually absorbed. Perhaps a great part of the principle concerned in this progressive approach to the surface is *pressure*. The harder tissues of the body, the bones themselves, yield and disappear before the increasing pressure of an aneurismal tumour. In this case the absorption appears to be independent of inflammation.

But taking the process as one of the events of inflammation, we may say, with Dr. Alison, that whenever the absorption or the detachment of the effused lymph, and of the surrounding textures, takes place in excess—in a greater degree, that is, and more irregularly than seems to be required for any useful purpose—the result is *ulceration*. The term is, however, commonly restricted to those cases in which the loss of substance occurs upon some *surface*, internal or external.

Many circumstances influence the occurrence and progress of ulceration; and great differences are observable between the different tissues, in respect of the facility with which they severally ulcerate. Ulceration is most common in the tegumentary membranes. It is frequently met with also in the inner coats of the arteries, in cartilages, and in bones. But we are not always sure that it is in these cases an event of inflammation. Ulceration is rare in fibrous tissues of all kinds, in serous membranes, and in the outer coat of arteries. These differences have important pathological bearings. But I may not stop to consider these at present: they will be particularly noticed as the course proceeds. When I state that ulceration may lead to perforations of the alimentary canal, of the air-tubes, of the gall and urinary bladders, of the blood-vessels, and to the fatal escape of the natural contents of these organs, I have said enough to convince you that ulceration, so frequently the object of the surgeon's care, requires no less attention on the part of the physician.

There are certain forms of ulceration that are specific in their nature: with these I do not at present meddle. The process of ulceration is very clearly explained in Dr. Alison's admirable 'Outlines of Pathology.'

There are three things generally going on at the same time in an ulcerated surface. First, there is an effusion of plastic lymph, by which what are called granulations are formed. Granulations consist of coagulable lymph which has become organised; furnished with numerous delicate blood-vessels. Secondly, there is suppuration: and, thirdly, there is the removal of degenerate or dead materials in solution, or in very minute particles, by a casting-off process; or more rarely by a process of absorption.

Sometimes, apparently, there is no *suppuration*: we see no pus in ulcers of the cornea, nor in certain cases of absorption of articular cartilages.

When the first of these three processes gets the better, if I may so speak, of the others, the lymph overspreads the surface of the ulcer, fills up the cavity, and the ulcer heals: cicatrisation takes place.

When, on the other hand, the ejecting (or sometimes, possibly, the absorbing) process predominates, the ulcer extends itself—the excavation grows larger, or deeper—or both larger and deeper: and when this excess of removal is great, and the extension of the ulceration rapid, it is called *phagedenic* ulceration. When a part of the textures perishes during the process of the ulceration, and is separated in entire and sensible masses, the ulcer is said to be a *sloughing* ulcer. 'When the process is slow, and the lymph effused at the base and round the edge of the ulcer is hardened, and the granulations on its surface are deficient, the ulcer is then said to be *callous* or indolent: and when the granulations are large, florid, and in excess, and require to be repressed before the ulcer will heal, to this variety of ulcer the name of *fungous* or *exuberant* ulcer is given:' and the coarse and too luxuriant granulations are called, by the vulgar, *proud flesh*. These several terms, in the senses now assigned to them, you will please to remember.

It is by regulating the three processes now described—as far as they are capable of being regulated by art—that the surgeon and the physician endeavour to obviate the threatened ill consequences of ulceration, and to promote the repair of the textures which have been destroyed.

I explained to you, in a former lecture, that inflammation may lead to a wasting of parts, although there is no suppuration or ulceration. The testis, for example, sometimes withers as a consequence of inflammation: *interstitial* absorption takes place. *Atrophy*, in short.

LECTURE XI.

Mortification, as an event of Inflammation. Inflammatory Fever. Hectic Fever. Typhus-like Fever. Modification of Inflammation by differences of Tissue: Areolar Tissue; substance of Glands and Solid Viscera; Serous Membranes; Synovial Membranes; Tegumentary Membranes—Skin—Mucous Membranes; Muscular Tissue; Arteries; Veins; substance of the Brain.

We were occupied, when last we met, with what may be properly called the *events of inflammation.* We passed in review, 1st, *resolution* as an event of inflammation; 2ndly, *serous effusion*; 3rdly, the exudation of *coagulable lymph*, constituting the adhesive form or stage of inflammation; 4thly, the formation of *pus*, or *suppuration*; and 5thly, *ulceration.* The pathology of these several events, so far as it is understood, and the change of symptoms to which they may respectively lead, were also treated of as fully as the limits of my course allow. At the close of the lecture I was about to speak of the sixth and last event of inflammation that requires to be noticed; viz. *gangrene, sphacelus, mortification.*

When mortification thus succeeds to inflammation, the part dies; it becomes cold; all circulation through it is at an end; all sensation in it is over. If it be an external part, its colour changes; from being red, it becomes mottled, purplish, green, or black; decomposition takes place; vesications appear, filled with dark-coloured liquids; air is extricated also. If there be a great accumulation of fluid in the part there may still remain tension; but usually the mortified part is flaccid and boggy; and it emits a cadaverous smell.

When *internal* parts mortify under inflammation, they do not always assume this black appearance: often they are yellowish; or the soft tissue of the dead part readily imbibes fluid, and takes the colour of the substances with which it has been in contact. We see sloughs of the mucous membrane of the intestines presenting the ochrey hue of the fæcal matters which had rested upon them.

What I have described as mortification, occurring externally, and succeeding to inflammation, is such as the surgeon witnesses. Sometimes it spreads, and loses and confounds itself, insensibly, with the adjoining parts, which still retain life; and which may continue actively inflamed, and subsequently perish also. Under more favourable circumstances, a distinct boundary line is formed between the dead and the living parts; and nature proceeds to amputate the portion which has lost its vitality. The process by which this is effected is extremely interesting. Adhesive inflammation constructs a barrier of lymph against any further advance of the mortification; a furrow of ulceration marks out upon the surface the commencing separation, and (supposing a part of one limb to have become gangrenous, the foot for example) the furrow gradually deepens, until the dead part is completely cut off. This very fact shows that all the textures of the body, skin, muscle, nerve, blood-vessel, and bone, are capable of being removed by the ulcerative process. Meanwhile very interesting changes occur in the part that lives: the large vessels are plugged up, to a certain distance, by the coagulation of the blood contained in them; the coagulation of the blood following its stagnation. They are further sealed up, and the smaller vessels are also closed, by coagulable lymph. Were it not for these changes, fatal hæmorrhage would follow the separation of the dead part. Now this is just what a surgeon rudely imitates when *he* amputates a limb; he cuts through the parts with knife and saw, and he ties the larger blood-vessels as he goes along. He follows the path which the natural processes point out: and I may here again impress upon your notice the fact that a great part of both physic and surgery consists in learning what are the expedients of repair and preservation for which provision has been made in the living body; in promoting or controlling, in directing or imitating, those natural actions which generally tend, and often suffice, to restore health, and to save life.

Mortification is more common in some external parts than in others. It is frequent in the areolar tissue; and in the mucous and submucous tissues of the alimentary canal; in the throat, for example, in cynanche maligna; and in the glandular parts of the intestines in fever. It seldom affects the other mucous systems—those which belong to the air-passages and the urinary organs. It occurs sometimes—but not very often—in the substance of the lungs. It is seldom met with in serous and fibrous tissues. It is not at all uncommon in bone: producing *exfoliation* when it is slight and superficial; *necrosis* when the entire shaft of a long bone dies. In these cases the process of repair is slow, and we can watch it at our leisure; and a beautiful process it is: but I must not stop even to admire it.

Now, mortification is no certain or constant event of inflammation. It depends, more or less, upon various causes and conditions. Sometimes upon the mere intensity of the inflammation, as in sloughing inflammation of the genitals: the progress of the mortification being best checked by those measures which are calculated to abate the violence of the inflammation. The sloughing of the cornea in gonorrhœal ophthalmia is another example to the same purpose.

Again, whatever tends to weaken the circulation in the part affected—or in the system at large—tends also to promote the perishing of the textures that are inflamed. In persons who are debilitated by fever, the mere pressure of the body against the bed may be enough to produce sloughing of the integuments of the sacrum, hips, and elbows. The same phenomena are apt to occur in parts that are palsied. In dropsical patients, with feeble and impeded circulation, we find that a blister on the extremities, where the circulation is the *most* feeble, will sometimes cause mortification; while it might be applied to the chest without any risk of that event. Probably, in each of these instances, the unhealthy condition of the blood conduces to the sloughing process. Inflammation of the stomach and intestines is marked by a strong disposition to run into gangrene—and this again is consistent with what I formerly mentioned, of the depressing influence of inflammation of these organs upon the heart.

It is necessary to remember that mortification is capable of being produced by other causes, as well as by inflammation. The death of frost-bitten parts is perhaps scarcely an exception—the phenomena of mortification occur in them after the application of a certain degree of heat—sufficient, probably, to give rise to more inflammatory reaction than the frozen parts can bear without perishing. But the mere cutting off the supply of arterial blood, independently of any inflammation, will cause mortification. Ossification of the arterial trunks, and consequent stagnation and coagulation of the blood in them, is the commonest cause of the dry gangrene of old persons—the *gangrena senilis*; which, by the way, is not always dry. In the majority, however, of these cases, the gangrenous part, not being preternaturally loaded with fluid, does not so rapidly putrefy; but remains dry, and shrinks up. Again, whatever tends to prevent the return of the venous blood from a part (as a firm ligature placed round a limb—or the constriction of the gut in strangulated hernia) is favourable also to the production of mortification. The impeded blood stagnates at length in the tissues, and death of the part is the result. We see limbs mortify sometimes after their principal artery has been tied for the cure of aneurism, when the collateral arterial circulation fails sufficiently to establish itself: we see the same thing when the passage of the blood through the main artery of the part is stopped, by external injuries; and I have already intimated to you that the artery *may* be plugged from within.

The difference between dry and moist gangrene is mainly this: that in the first, the tissue dies through defect of blood; in the second, through stagnation of blood.

There is also a very curious form of chronic and dry gangrene, produced by the continued use of diseased grain as food—and particularly of the spurred rye; and to this, as a distinct disease, I may perhaps have occasion to direct your attention hereafter.

The different stages and events of inflammation that have now been described are accompanied by corresponding disturbances of the system at large. These were touched upon (barely mentioned, however) in that rough and general outline which I attempted to sketch in the outset, of the various phenomena of inflammation; and to which I have since referred as a type. They require, for many reasons, to be considered somewhat more minutely.

When, as *surgeons*, you have to deal with *external* inflammation, you have no difficulty, in the first place, in ascertaining its actual existence: you see it; and you know besides, merely by looking at the part, and perhaps by handling it, what changes it has undergone. You may perceive that the opposite lips of a wound have adhered: or that a phlegmon, in which you can also detect fluctuation, has assumed a pyramidal form, and begins to look white upon its summit: or you observe that the abscess has broken, and left an ulcer behind it, which pours out pus, and which shows a tendency to contract, or to enlarge itself: or you may remark the alteration of colour and of temperature which denotes the approach of mortification, or the actual death of the part. The mere exercise of your external senses apprises you, not merely that there is inflammation, but also whether it is of the *adhesive* kind; or has reached the degree of *suppuration*; or has produced *gangrene*. At the same time you do not fail to notice the nature of the *constitutional* disturbance that may be present; and the knowledge thus obtained of the local and of the general symptoms determines your plan of treatment.

But when, as *physicians*, we have to do with inflammation of *internal* parts of the body, and when the local changes attendant upon that process are concealed from our view, the case is very different. We should often be unable to make out the nature of the disease at all, if the presence of pyrexia did not instruct us. Sometimes the constitutional disturbance is all that is apparent, until after death. And as the disease proceeds, we frequently are able to judge that this or that *event* of inflammation has taken place, only by observing the indirect symptoms which declare themselves through the medium of the system at large. Yet it is in many cases of the greatest importance to mark the transition from one stage or event of inflammation to another; and to learn whether, and in what degree, the more urgent of the symptoms depend upon the inflammation itself; or upon the effects which it has produced. I do not mean to say that we have not, sometimes, as sure indications afforded us by *direct* symptoms, cognizable by the sense of hearing or of touch, of the state of internal organs, as we *could* have if they were exposed to our view. To these direct symptoms I am not now about to refer; they must be spoken of in connection with the diseases to which they belong. But the information which the physician gains from what may be called *constitutional* symptoms is *always* highly valuable: and it is *sometimes* the *only* information that offers any guidance to the remedial measures he ought to adopt.

Inflammation sufficiently extensive or intense to disturb the general system at all, is attended with pyrexia: and the presence of pyrexia, when the part affected is unseen, marks the *nature* of the disease. The most prominent of the symptoms that denote the existence of *inflammatory fever* are increased heat of skin, ushered in usually, and sometimes alternating with, feelings of debility and chilliness; increased frequency, often increased force also and *hardness*, of the pulse; with considerable derangement of most of the natural functions of the body. Commonly there is headache and confusion of thought, languor, thirst, scanty urine, loss of appetite, a furred or a white tongue.

Of these the one essential symptom is the increase of temperature—as is indeed implied in the very terms *fever*, and *pyrexia*. The chilliness, often amounting to shivering, has this particular importance attached to it, that it marks the *date* of the febrile disturbance. And it is worth observing that rigors more commonly attend the commencement of spontaneous inflammation, than of inflammation caused by external injury.

Now, without going more into detail—of this febrile condition belonging to the early stage of inflammation, I make the following remarks.

1. That it generally *succeeds* the manifestation of the local symptoms of the inflammation: and that we cannot, therefore, help considering the fever as the natural *effect* of the inflammation.

Kaltenbrunner describes an experiment of this kind. He says, if a drop of alcohol be applied to the web of a frog's foot, the blood presently flows towards the part irritated, and the circulation in it is accelerated; *congestion* takes place, and follows its known march.

If the dose of alcohol be augmented, the phenomena of congestion increase considerably, and extend over a larger space: at length points of stagnation appearing in the focus of the affected part announce the establishment of *inflammation.*

If the dose of alcohol be still further increased, we observe that, on the one hand, the inflammatory points of stagnation become larger and more numerous; and that, on the other, the circumferential disturbances of the circulation extend themselves, so as at length to implicate the whole of the circulating system: they give rise to a *fever,* which is *added* to the *inflammation.* The circulation in the web of the opposite foot is as much accelerated as in the vessels surrounding the inflamed part in the first foot. If the word congestion had not a local meaning, we might call fever (he says) a general congestion.

It seems probable that the pyrexia is produced by the circulation throughout the body of blood which has been altered by its passage through the area of the local inflammation. We know that it is so far altered that it contains an increased amount of fibrin, and has acquired that unnatural quality which is expressed in what I have described as its 'buffy coat.' We know even more, and more to the purpose, than this. We have seen that the blood in the inflamed part is actually hotter than that of the arteries which supply the part—hotter apparently in consequence of the chemical changes going on in the part: that the blood is hotter in the veins which carry blood from the inflamed part than in the supplying arteries; hotter also in those veins than in the corresponding veins of the opposite side of the body. There are therefore increments of heat continually passing into the circulating blood. In this way it is quite conceivable how the pyrexia may become a direct consequence of the inflammation.

That the febrile state follows the local inflammation in point of time, is, I say, the rule; but this rule has frequent exceptions. Erysipelas, and all the febrile exanthemata, afford instances of exception; the fever sets in before any manifestation at least of the local symptoms. These are indeed diseases of a specific kind, in which the blood is believed to be infected primarily; but the same is true sometimes of diseases that seem to be simply inflammatory; such as inflammation of the lungs, and cynanche tonsillaris. There are other cases in which the local symptoms and the general febrile disturbance appear to burst forth simultaneously; at any rate we are not able to detect the interval that may separate them: this is seen in certain instances of pleurisy, and of peritonitis.

2. Again, it is a curious circumstance that the inflammatory fever is not always proportioned, in its degree of violence, to either the size or the importance of the part inflamed. The pyrexia is often very strongly marked in that common complaint, the quinsy, inflammatory sore-throat, cynanche tonsillaris —which can scarcely ever be said to imply much danger.

3. The situation, the extent, and the degree, of the local inflammation being the same, the fever commonly runs higher in young, and in plethoric persons, and in those of sanguine temperament, than under the opposite conditions.

4. The inflammatory fever may be modified in the outset, or very early indeed, by the nature of the part upon which the inflammation has seized. I have several times mentioned the peculiar depressing effect upon the action of the heart, produced by inflammation of the stomach and bowels, and of some other of the abdominal organs; and particularly by inflammation involving their peritoneal covering. This lowering influence (which is analogous to that of certain mechanical injuries to the abdomen) has been supposed to depend upon the subduing and sickening kind of pain which is apt to accompany inflammation of these parts. Probably such pain accompanies, rather than causes, the depression. However the depression may arise, it gives a peculiar character to the inflammatory fever; lessens the amount of reaction, or abridges its duration; affects especially the quality of the pulse; and carries with it a strong tendency towards death by asthenia.

5. There is no doubt either that the character of the inflam-

matory fever is liable to be considerably modified, from the first, by the previous habits, and the previous health, of the patient. In persons who have been habitually intemperate—or who have been subject to long-continued excitement of the nervous system, of any kind—the fever which attends inflammation approaches more or less to the type of typhus fever, from the very beginning. The febrile reaction is less strongly pronounced. The functions of animal life are sooner and more deeply involved in the train of morbid actions. Stupor and delirium are apt to occur; with extreme debility and irregular movements of the voluntary muscles. Still more conspicuous are these peculiarities in some cases of inflamed veins; and whenever inflammation is produced or accompanied by the introduction of certain animal poisons into the system.

6. The relative duration of the inflammatory fever is subject to some variety. It may persist for a little while, for a few days even, after all the local signs of inflammation have disappeared: this happens chiefly in persons of an irritable habit. We watch such cases narrowly, not without some apprehensions of a relapse. On the other hand, a rapid abatement of the febrile symptoms sometimes takes place, while the local changes continue, or even for a time increase in extent: this is well seen in some cases of pneumonia. Nevertheless, we hail the change as a favourable augury of the ultimate result.

When inflammation, external or internal, has gone on to the formation of pus, *that* event is frequently marked by the supervention of peculiar symptoms; and the character of the fever undergoes, for the most part, a striking alteration.

It is very important to ascertain the time when this event of inflammation takes place, or is at hand: for the measures which might have been proper and necessary while any prospect remained of the *resolution* of the inflammation, may be useless and even hurtful, if continued after that prospect is at an end.

When the surgeon perceives any indication of the formation of pus in an external part, he mostly despairs of being able to bring about resolution; ceases to abstract blood from the part; and applies perhaps warmth and moisture, by means of a linseed poultice, to promote the suppuration. And a corresponding change of plan is required in internal inflammations.

Now, the *commencement* of suppuration is often marked by rigors; and its *continuance* by *hectic fever*.

If, after the symptoms of inflammation have lasted for a certain time, the patient be attacked by cold shiverings, which are followed by some increase of heat, that circumstance alone is enough to make us suspect that pus is formed, or is about to be formed: and to teach us that the measures employed to effect a resolution of the inflammation have not been successful.

Rigors are very striking symptoms; but they are by no means necessarily connected with suppuration. They depend upon some peculiar condition of the nervous system. On a future occasion I shall have to tell you what is known, or believed, respecting the general pathology of rigors. They usher in, as perhaps you know, most forms of fever, appearing at the very outset of the disease. They recur, at regular intervals, in intermittent fevers. Slight causes will, sometimes, produce them. For instance, they often follow the introduction of a bougie into the urethra. Occasionally they occur as isolated symptoms, *apropos* as it were to nothing. But when they happen *after symptoms of internal inflammation have been for some time present*, they denote, in most cases, the production of pus in the part or organ inflamed. Sometimes one such shaking fit only is observed: sometimes several take place. When they recur, it is usually at irregular intervals; but cases do happen in which the shiverings indicative of internal suppuration are so strictly periodic, that unless all the circumstances be carefully taken into account, these shivering fits may be mistaken for signs of ague.

The leading symptoms of *hectic fever* (by which, I say, the *continuance* of suppuration is commonly marked) are an abiding frequency of pulse; alternations of chilliness with heat and flushing, followed by perspiration; a gradual wasting of the body; and progressive debility.

I shall hereafter have to speak of a very different kind of disease, in which, however, there is a succession of symptoms resembling more or less closely the series that characterises hectic; I mean *remittent fever*; the succession of symptoms being chilliness, heat, perspiration. But these two disorders are in most cases discriminated from each other by the circumstances under which they occur.

The symptoms of hectic fever often creep on, at the outset, insidiously, and almost imperceptibly. 'A very slight degree of emaciation, a pulse a little quicker than ordinary, with a small increase of heat, especially after meals, are often the first symptoms which can lead us to suspect the formation of hectic.' Cullen has described hectic fever as consisting of two exacerbations in the twenty-four hours—one about noon, the other towards evening; but in many cases the latter alone is distinctly marked. The patient feels shivery and cold towards night; then the skin becomes hot and dry, especially in the palms of the hands and the soles of the feet, and the pulse becomes *more* frequent; and in the middle of the night, or towards morning, he wakes from short and uneasy sleep, in perspiration, which is often profuse. Sometimes, however, there are two or three fits in a day. The paroxysms are shorter and less regular than those of intermittent or of remittent fever. Each of the three phenomena constituting the series may, in its turn, be wanting: and even if the paroxysms are regular for two or three times together, they never continue to be so. Many circumstances connected with the paroxysm itself are very distinctive. 'The hectic patient,' says Dr. Heberden, who has left us a very good account of this affection in his 'Commentaries,' 'is very little or not at all relieved by the breaking out of the sweat; but is often as restless and uneasy after he begins to perspire as he was while he shivered or burned. All the signs of fever are sometimes found the same after the perspiration is over; and during their height the chilliness will in some patients return, which is an infallible character of this disorder. Almost all other fevers begin with a sense of cold, but in them it is never known to return and to last twenty minutes or half an hour, while the fever seems at its height, which in hectic will sometimes happen.'

Hectic fever is one of the fearful accompaniments, and sometimes the most strongly marked symptom, of pulmonary consumption: and where the existence of that complaint is suspected, yet a matter of doubt, we look for indications of hectic fever with the greatest anxiety and dread.

With relation to hectic fever, considered as an indirect symptom that suppuration has succeeded to inflammation, and is still going on, it will be worth your while to notice the strong contrast it offers, in many particulars, with the *inflammatory* fever that attends the earlier stages of inflammation.

The pulse loses much or all of its *hardness* and strength, but it remains permanently more frequent than the pulse of health; the appetite returns in great measure; the thirst abates; the tongue, instead of being covered with a white fur, becomes clean and moist, and towards the end is sometimes unnaturally red, or speckled with aphthæ; there is no longer headache or confusion of thought.

A few more touches will suffice to fill up the picture of hectic fever.

The face is usually pale; but during the exacerbations it is partially flushed, and very often a characteristic circumscribed red spot appears upon either cheek. Besides the evident emaciation, various minor changes mark the want of proper nourishment: the skin, when not perspiring, is harsh and scurfy; little branny scales may be rubbed from the legs, merely by the friction produced in drawing off the stockings; the hairs become fine and fall off; the finger-nails are incurvated into an adunque form; and the sclerotic coat of the eye, as seen through the conjunctiva, becomes of a pearly white. As the disease advances, œdematous swellings of the ankles are very apt to come on.

The connection between hectic fever and the formation of pus in some part or other of the body is so frequent, that it has been deemed, by persons of great experience and sagacity, a *universal* fact. Dr. Cullen tells us, in his 'First Lines,' that he had never seen hectic in any case, when there was not evidently, or when he had not ground to suppose there was, a permanent purulency or ulceration in some external or internal part. And Dr. John Thomson, speaking of the opinion that hectic might occur independently of suppuration, uses these words:—'But till facts more decisive, and cases more accurately described than any which have yet appeared, are produced in proof of that opinion, I shall think myself justified in adopting the *common* opinion; and in believing that hectic fever is in every instance connected, if not with the *absorption*, at least with the *formation* of pus.'

The notion alluded to in the latter part of this quotation was at one time very commonly entertained, viz., that hectic fever resulted from the re-absorption of pus into the blood; but there are many facts decidedly opposed to this belief. Considerable collections of matter not unfrequently disappear, i.e., are taken up again into the blood, without occasioning the slightest approach to hectic. Again, hectic will accompany, and be kept up by, a scrofulous joint attended with an open sore, and it will sometimes cease at once, and completely, upon the removal of the diseased limb by amputation; although a greater quantity of pus is secreted by the stump, than had been secreted in the diseased part previously to the operation. Facts like these prove, I think, that hectic is not simply a consequence of the absorption of pus into the blood: and they seem to have suggested to Mr. Abernethy the notion (which was held, indeed, by John Hunter also) that sympathetic hectic fever is a *teased* action of the system, endeavouring to throw off what annoys it: the cause of irritation being removed, it ceases forthwith.

And there is another conclusive circumstance to be mentioned. Notwithstanding the opinions I just now quoted from Drs. Cullen and Thomson, I believe few persons who have attended to the subject, doubt, now, that there is such a thing as *idiopathic* hectic: hectic unconnected at least with suppuration anywhere. We often see hectic, or a general state of the system not to be distinguished from hectic, in mothers who have suckled their infants too long: we see it, too, sometimes, if I mistake not, in newly-married husbands: and it may be noticed as occurring more or less distinctly in those who labour under diabetes. What is common to all these cases is, that there is an habitual drain upon the system beyond what the nutriment taken into it can supply and counterbalance. It is certain, too, that hectic fever sometimes happens in phthisis, not only before there has been any expectoration of puriform matter, but prior even to the softening and suppuration of a single tubercle. I call to mind one instance in particular of this. The hectic was distinctly marked, and continued long. The patient died, at last, comatose, after two attacks of convulsion. Two or three large scrofulous tumours were found imbedded in the substance of his brain. The lungs and various other organs were infested with tubercles; but the tubercles were all of them still hard and crude.

However, setting aside these rarer cases of exception, there can be no doubt that hectic fever, considered as a constitutional symptom of mischief that *may* reveal itself by scarcely any other token, and especially as a sign of suppuration, deserves all the attention we can give it; and for that reason have I spoken of it rather at large. Whenever I mention hectic fever in the further progress of these lectures, you will know all that I wish to express by that term.

I have very little to say at present respecting that modification of the general febrile disturbance, which sometimes attends *mortification* as an event of inflammation. I stated before that the fever is apt in these cases to assume those features which belong to the later stages of typhus fever; and to be characterised by sinking of the pulse, shrunken cheeks, coldness and clamminess of the skin, a dry and black tongue, low muttering delirium or stupor, tremors of the voluntary muscles, with spasmodic startings of their tendons, and insensibility to the passage of fæces and of urine. I must, however, now inform you that these typhus-like symptoms are no constant or necessary concomitants of mortification. The natural mode of death, under gangrene, is death by asthenia. But typhus in its advanced state involves the nervous functions, and tends to death by coma. Whenever, therefore, typhus-like symptoms supervene upon inflammation which ends in sphacelus, they may with much probability be attributed to some contamination of the blood by an animal poison; and such contamination may have taken place previously to the mortification, and have even helped to produce it, as when inflammation arises during the progress of the contagious febrile disorders; or it may occur as a consequence of the mortification itself, through the direct absorption into the system of some of the putrefying and poisonous elements, into which the dead part has been resolved.

One circumstance, worth bearing in mind, as sometimes indicating the supervention of internal mortification, is the sudden cessation of pain: giving hope to the patient and his friends that the danger is over; but not deceiving the experienced physician.

So much, then, for the local and constitutional events of inflammation, considered generally.

It remains for me to make some observations upon the modifications of inflammation, according as it affects the *different tissues* of which the body is composed. Many of these observations I have, indeed, already anticipated; but it will be useful to bring together, under one view, the most material facts ascertained on this matter.

When inflammation affects the *areolar tissue*, all the events of inflammation which I have taken some pains to describe are apt to occur; and for that reason, inflammation of this tissue, as it exists beneath the skin, was chosen by me as a convenient type, or general representative of the inflammatory process. It is, therefore, the less needful that I should take up much of your time in speaking of the characters of inflammation exhibited in areolar tissue. There is a strong tendency to form circumscribed abscesses: the extension of the suppuration is prevented by a wall of lymph built up around it. The adhesive inflammation sets bounds to the suppurative. There is a good deal of pain when the areolar tissue is so situated that tension is occasioned by its swelling.

But sometimes no such boundary wall is erected, and the inflammation spreads and diffuses itself, and becomes a very terrible disease, destroying the areolar tissue over a large and undefined space by a process compounded of sloughing and of bad suppuration. When the skin also is implicated in the inflammation, the disease is usually called *erysipelas phlegmonöides*: when the skin is not involved, it has been called *diffused inflammation of the cellular membrane.* This diffused form of inflammation frequently follows the introduction of animal poisons into the system; and accompanies the inflammation of veins and of absorbent vessels. It is this disease which is so often fatal to members of our profession, when it results from wounds or punctures received in opening dead bodies. The late Dr. Craigie held the opinion that in these cases of spreading inflammation it is the *adipous* tissue that is affected.

The substance of the *larger glands, and of the solid viscera* of the body, suffers changes analogous to those observed in the areolar tissue. Acute inflammation of the liver, when it does not terminate in resolution, leads to abscess in that organ. Abscess is rare in the lungs, perhaps for the reasons mentioned in the last lecture: partly also, perhaps, as suggested by Dr. Stokes, because the early products of inflammation can readily escape from the lungs, whereas in the substance of the liver, or of the brain, where abscess is more common, they are closely shut in. Gangrene is also uncommon in the pulmonary substance: and quite unknown, I believe, in the liver, and very rare in the kidney. Inflammation of the latter organ is not unfrequently attended by purulent collections. Inflammation of the substance of the viscera is not, in general, attended with much pain.

The areolar tissue is liable to be rendered permanently thick and hard by *chronic* inflammation, as well in the parenchyma of internal organs as where it is spread out beneath the skin, or beneath serous or mucous membranes.

The inflammation of *serous membranes* is characterised by sharp and severe pain; by hardness of the pulse; and by buffy blood; by its tendency to spread; by the effusion of serous fluid, and of coagulable lymph; and sometimes, when the inflammation is very violent, or air gets admitted to the inflamed surface, by the effusion of pus. Speaking generally, however, it is *adhesive inflammation* which we most expect in this tissue. False membranes, consisting of organised lymph, belong to it: and the agglutination of contiguous surfaces. Sometimes the lymph, instead of being deposited in flakes or layers, appears in the form of numerous small granules: this is a phenomenon frequently observable in inflammation of the arachnoid, and of the peritoneum. Sometimes it has a villous or papillary or shaggy arrangement; or is cellular like a honeycomb. This is common in the pericardium. The surface (to use the happy simile of Laennec) resembles that which may be produced by separating two flat plates between which a layer of soft butter had been spread: and it probably depends upon a similar cause, since in health a perpetual sliding motion of the pericardium over the heart is going on. Ulceration of a serous membrane is very uncommon. I mean ulceration *commencing* in that tissue; for these membranes are frequently perforated by ulcers which approach them on their attached side, and which begin in other tissues, especially in the mucous. Neither does mortification occur in serous membranes, except sometimes by communication from other parts. The effect of *chronic* inflammation of the serous surfaces is to thicken, harden, and pucker them. We see this effect in the omentum frequently; in the peritoneal covering of the liver; in the serous membrane which forms so large a portion of the valves of the heart.

The *synovial membranes* have a strong analogy to the serous. Gendrin includes the two in the same category: yet their behaviour under inflammation displays, in some respects, a marked distinction between them. They are less *liable* to inflammation than the serous membranes: they rarely throw out coagulable lymph, and, consequently, adhesion of their opposite surfaces is very uncommon. Joints do not become immovable, or what is called anchylosed, in consequence of the agglutination of their synovial surfaces; but, generally, by means of granulations arising upon those surfaces after they have ulcerated. Very seldom indeed does pus form in the synovial sacs, except (again) the inflammation has been caused by mechanical injury, which has laid open the joint, and admitted air. When this is the case, very serious constitutional disturbance is apt to take place, and the existence of the sufferer is endangered. That this does not depend upon the *mere violence of the exciting cause* is evident from the circumstance that the same acute inflammation, the same general affection of the system, and equal danger, often result from the careful incision made into a joint by the surgeon, for the purpose of removing loose portions of cartilage. I have now at the hospital an out-patient who has, among other ills, a large cartilage floating about in fluid in one of his knee-joints: but I believe that Mr. Arnott, whom I have consulted on the case, will be very slow to recommend its extraction, unless the inconvenience produced by it becomes so great as to incapacitate the patient from pursuing his employment, and other methods of relief shall fail. Suppuration of the joints is also no unfrequent consequence of what has been called *pyæmia*. Inflammation of the synovial membrane speedily leads to a *serous effusion* into the joint, which often, especially in rheumatism, is as speedily taken up again.

Let us next enquire into the modifications which inflammation undergoes when it affects the *tegumentary membranes.*

Considering the *skin* as *one membrane*, and neglecting its subdivisions into epidermis, rete mucosum, and cutis vera, we find that inflammation assumes a variety of forms in this external covering of the body. Many of these belong to specific diseases, and do not fall within my present purpose, which is that of noting how *common* inflammation varies in the different tissues.

When the inflammation is superficial, it frequently is denoted by a diffused red blush only, which may be banished for the moment by the pressure of one's finger, and which after a certain time disappears of its own accord—terminates by resolution; the only consequence of the inflammation being the separation of the cuticle in small branny fragments; in one word, *desquamation.* We call the superficial inflammation in this case, *erythema.* If the inflammation have been a little more intense—as in some cases of *erysipelas*, in *scalds*, and in that which we are every day exciting by *cantharides*—a serous fluid is poured out, which elevates the cuticle in larger or smaller patches of vesication. Remove the cuticle and admit air, and the *serous* effusion becomes *purulent* effusion: and if the inflammation be pressed beyond a certain point by any *other* stimulus besides that of air, we may then too have pus poured out. Erysipelatous (which is also a specific) inflammation of the skin is characterised by its remarkable tendency to spread; and a most singular circumstance attends several of the other specific inflammations of the skin—viz., that having occurred once, they never occur in the same person again: this peculiarity belongs, however, to the great constitutional diseases, of which the cutaneous affection forms merely a part.

Inflammations of the *internal* tegumentary membranes—of the three internal surfaces that communicate with the air, and are clothed with *mucous membrane*—are very interesting to the physician: and the first thing which strikes our attention with respect to them is the indisposition they manifest to adhesive inflammation: and we are struck at the same time with the beauty of this provision. If the mucous membranes were as ready to throw out coagulable lymph, and to adhere to each other, as the serous, almost every occurrence of inflammation in them would prove necessarily fatal; by closing up the *inlets* of the air-passages; or the outlets of the urinary passages; or any part of that long mucous canal which, passing through the body, requires a free opening at both of its extremities. But the inflamed mucous membrane pours out serous fluid; or viscid mucus; or pus; or blood. The product partakes at first of the character of the secretion proper to the part inflamed; or it is mixed with some of that secretion. Inflammation of these membranes is, however, sometimes attended with the exudation of something which is very like coagulable lymph. The tracheal, bronchial, and pulmonary mucous membrane, the œsophageal, the intestinal, and that which lines the urinary and genital organs, are all more or less subject to the formation of adventitious membranes under inflammation. Casts of the smaller branches of the air-tubes have, in rare instances, been repeatedly coughed up in large quantity; constituting what have been very inaptly called *bronchial polypi.* The membranous exudation of croup is well known; a tubular substance is formed in the trachea, and, sometimes, fortunately expelled: but too often it suffocates the patient. The leather-like membrane of diphtheria is another example. Similar concrete exudations, broken into irregular shreds, are occasionally voided by stool. It is said that a long membranous mass of the same kind, in size and shape like an earth-worm, has been discharged from the urethra; having formed there in consequence of the injudicious use of stimulating substances, injected with the view of checking the more innocent effusion of pus. The films, or membrane-like flakes which are thus incidental to inflammation of the mucous surfaces, resemble, I say, in their general appearance and disposition, the strata or layers of coagulable lymph which are the ordinary product of inflammation of the closed serous surfaces. But they differ from these in some remarkable points. They are softer. They never contract permanent or strong adhesions to the subjacent or inflamed membrane; but are partially separated from it by the intervention of thinner matters, serous or puriform. Above all, they never become organised. They appear to consist of inspissated and altered mucus; and are composed, in a great measure, of albumen. An opinion has been entertained that the *want of apposition* of the opposite surfaces has a great deal to do with their indisposition to cohere. The mucous *air*-tubes are kept open and apart by their *structure*: the stomach and intestines by their *contents*, or by the frequent passage of solids and fluids through them: and therefore (it has been supposed) they have no *opportunity* of adhering. But there can be no doubt that these mucous membranes are but little disposed to throw out true plastic lymph at all: and when their opposite surfaces do grow together, I believe it will almost always be found that some abrasion or ulceration of the mucous surface had previously happened.

Inflammation affecting the mucous membranes has sometimes a strong tendency to spread and wander: sometimes, on the contrary, it is strictly confined to a small and definite space. In the former case it commonly restricts itself for a long time, or altogether, to the mucous tissue, leaving the neighbouring tissues untouched. In the latter it is apt to penetrate to the subjacent parts, and to produce obvious and enduring alterations of structure. The membrane becomes fastened to the parts which it should loosely clothe, and not unfrequently it ulcerates or sloughs.

The spreading form of inflammation is most often met with in the air-passages. Ulceration and sloughing, and circumscribed inflammation, are more common in the alimentary canal.

There is a remarkable contrast between the serous membranes and the mucous, with respect to the *pain* which attends their inflammation. Very little pain is experienced in many cases, when inflammation affects the mucous lining in any of the three systems, except towards their openings, where the membranes are about to become continuous with the external skin: in the mouth and throat, for example, the pharynx, the rectum, the vagina, the extremity of the urethra. And as inflammation of the mucous membranes is attended with less *pain*, so also it is accompanied by less *fever* than when the serous membranes are attacked; and the blood, when drawn, more seldom exhibits the buffy coat.

The *muscular tissue* appears to take on the actions of inflammation very reluctantly: and its vessels seldom, if ever, pour forth any of the products of inflammation. The chief effect of inflammation upon muscle is the destruction of its contractile properties. Serum and lymph, and even pus, are sometimes found diffused through muscular parts; but there is reason to believe that these effusions are rather the consequence of inflammation of the areolar tissue which enters into the composition of the muscle, and ties together its fleshy fibres, than of inflammation of those fibres themselves.

I have remarked already that inflammation of an *artery* presently leads to the effusion of lymph, and the coagulation of the blood, within the artery. But arteries do not readily inflame, except under mechanical injury: they do not often suppurate either: and they possess a singular power of resisting mortification. Dr. John Thomson declares that he has seen cases of phlegmonous erysipelas, in which 'several inches of the femoral artery were laid completely bare by the gangrene, ulceration, and sphacelus of the parts covering it, without its giving way before death.'

Inflammation of the *veins* is much more common than that of the arteries; and it is a disease of fearful interest. In some cases it leads to a deposit of fibrin upon the inside of the vessel, 'furring it over,' as Mr. Hunter says. The blood soon coagulates, and blocks up the inflamed vein, or leaves, perhaps, a narrow passage in its centre. From this mechanical obstruction to the current of the blood new symptoms arise. The part from which the venous trunk receives its tributary branches becomes œdematous or dropsical. Inflammation of the femoral vein, obliterating its cavity, is the essence of the complaint known to pathologists under the name of *phlegmasia dolens*: a complaint which may happen to persons of any age, and of either sex; but which is most common in women, soon after parturition.

This, which may be considered the adhesive form of phlebitis, is also its most innocent form. Too frequently the inflammation runs into suppuration: and then it proves a most terrible and almost hopeless disorder. The vein remains pervious; pus, of an unwholesome and poisonous quality—or some morbid product of the inflammation—is carried into the blood; which thus scatters, in its course, the seeds of inflammation, and determines the rapid formation of purulent collections in various and distant parts of the body, and especially in the lungs, the liver, and the larger joints. Great constitutional disturbance ensues, and fever of a type like that of typhus is often established. To this, the destructive form of the disease, parturient women are also peculiarly liable. Inflammatory contamination of the uterine veins constitutes the source of the most dangerous and deadly varieties of puerperal fever. It is the same disease which gives to a vast majority of those surgical operations that are followed by death, their fatal character.

We hear continually of inflammation of the *brain*; but what is so called is, most commonly, inflammation of the *membranes* which invest the brain. Inflammation of the cerebral substance itself is, however, not very uncommon; but it is more frequently the result of injury than of spontaneous disease, and it is usually confined to a limited portion of the brain. Softening and suppuration are its ordinary events. Sometimes pus is met with occupying a distinctly circumscribed space; the pus is collected into an abscess. Sometimes, on the other hand, it lies loose, as it were, and surrounded by broken-down cerebral matter, or it is infiltered into the cerebral pulp. Around the softened portions the inflamed substance of the brain is more dense and firm, sometimes, than is natural. Whether this be owing to the presence of coagulable lymph, has not (so far as I know) been clearly ascertained. Mortification must be very rare in the nervous substance. Dr. Baillie has described it as occurring after violent injuries. Once or twice in my life, portions of the brain have been shown to me, protruding through an aperture in the skull, dead, of a dark colour, and having an offensive smell. Excepting in these cases of *hernia cerebri*, I have never seen sphacelus of the brain from any cause.

Perhaps, however, I am incorrect in saying this. I formerly told you that portions of the brain often become soft and diffluent, when there has been no inflammation; but simply from atrophy, depending on a diseased state of the nutrient arteries of the brain. Now *this* is, by some persons, called mortification of the cerebral substance. They consider it quite analogous to the gangrena senilis, which results from a similar cause, although it happens in another part of the body. The nature of the change, they say, is the same, although its physical characters differ. If this be so, I have seen gangrene of the brain some scores of times; but still I should be able to declare, that with, perhaps, the exception already mentioned, I have never seen unequivocal mortification of the cerebral substance *as the result of inflammation*: which is what we have now been considering.

In whatever tissue inflammation may arise, its phenomena are liable to be sensibly influenced and modified by different conditions of the body, or of the blood, of the patient whom the inflammation befalls.

This concludes, Gentlemen, what I have to say concerning the phenomena of common inflammation, as they are perpetually witnessed in the various textures of the body. I have not, indeed, gone through all the tissues; I have said nothing of the peculiar effects of inflammation in cartilages, for example, and in bones; but I have glanced at all those tissues, in the inflammation of which the physician is chiefly concerned. Upon such points as I have purposely omitted, you will be amply instructed by my colleague, the Professor of Surgery.

LECTURE XII.

Varieties of Inflammation: Acute and Chronic; Latent; Specific. Scrofulous Inflammation. Tubercles. Relative frequency of Scrofulous Disease in Different Organs. Signs of the Strumous, and the Tubercular Diathesis.

We have now, Gentlemen, considered the phenomena of inflammation, local and general; its symptoms and its events; and the intimation of those events which is afforded by the state of the system at large; and we have surveyed the principal tissues of the body, and observed the modifications and peculiarities to which the process of inflammation is liable, according as it is situated in one of those tissues, or another.

In regard to this part of our subject—and indeed in regard to the whole subject of inflammation—I cannot too strongly recommend to you the diligent study of Mr. Paget's invaluable 'Lectures on Surgical Pathology:' and of Mr. Simon's essay on Inflammation in the 'System of Surgery.'

There are still some varieties of inflammation; and some epithets applied to inflammation; which require to be explained.

Acute, and *chronic*, inflammation: these are words perpetually in our mouths. I have frequently employed them already. What do they mean? Is acute inflammation different from chronic in *kind?* No; they differ only in *degree*.

When the disease runs its course rapidly, and is attended with much general as well as local disturbance, it is said to be acute. When, on the other hand, the local and constitutional symptoms are less violent, and the inflammation runs a longer course, its phenomena following each other in slower succession, it is said to be chronic. The process is the same, but its features are less strongly expressed. The disease passes through similar stages in both cases, but it travels at a different pace. The characters, then, of acute inflammation are intensity of symptoms and rapidity of progress: and the characters of chronic inflammation are mildness of symptoms and slowness of progress. Inflammation can scarcely be very violent, and at the same time of very long duration. When violent, it has been likened (by Mr. Lawrence, whose language I have here adopted) to a blazing fire, which soon burns itself out. It may, however, be mild in its symptoms, and yet quickly over. The two terms acute and chronic are not directly opposed to each other; acute has more relation to the intensity, chronic to the duration of the disease; and some term is wanted—although it is hardly worth seeking for—to denote such a degree of inflammation as exists in a pimple: which is neither severe nor long-continued.

Now, in respect of intensity and duration, there are innumerable shades of difference in different cases of inflammation; and the same difficulty occurs here which always occurs when general terms are employed to express mere differences of degree. We feel no uncertainty or hesitation about those cases which occupy the two extremes of the scale; but with regard to those which lie in the middle we are often at a loss. To meet this difficulty some pathologists have invented a third epithet, viz., *sub-acute*, intending to designate thereby cases which hold an equivocal rank; which are neither decidedly acute nor plainly chronic; in which the inflammation may run a brief course, and be attended with a certain degree of fever; but attains no great intensity, works no profound changes, and does not require very energetic remedies to control it.

Do not suppose that, because chronic inflammation is attended with less tumult and disturbance, it is necessarily on that account less dangerous or less destructive than acute. The latter is commonly more obedient to the influence of remedies than the former; usually it is soon brought, or comes, to an end: whereas chronic inflammation is often obstinate and abiding, and leads to very serious changes in the part upon which it fastens. Speaking generally, it tends to thicken and indurate when it is situated in the *interior* of organs, and to the effusion of pus when it affects *membranes*, or *surfaces*. It is more common in weakly and debilitated persons than in others; but you must not forget that such persons are also very liable to acute inflammation.

Chronic inflammation is not unfrequently a *sequel* of acute inflammation. And that the two differ merely in degree, and not in kind, is evident from this: that acute inflammation may sink or subside into chronic; and that, on the other hand, chronic inflammation may readily be aggravated into acute.

There is another, but less intelligible division of inflammation into *active* and *passive*. I believe that they who use the term passive inflammation, intend to signify by it that languid and sluggish kind of inflammation which is apt to occur under the same circumstances, and in the same conditions, with passive *congestion*. When the granulations of an ulcer are in that state in which they may be made brighter, smaller, and healthier, by the application of a stimulus: when the blood-vessels of the eye are left, after acute inflammation, turgid and tortuous; and that condition is improved, instead of being worsened, by the use of a stimulating lotion: in such cases as these, some persons would say there was passive inflammation. But I see little difference between this and chronic inflammation; nor do I recognise any distinction between *active* and *acute* inflammation.

The term *latent* inflammation is one of modern introduction. It is applicable to those cases in which internal inflammation runs its course silently, treacherously, and unperceived; without the usual warning tokens of its presence; without its more striking and prominent signs. The smouldering fire is hidden from our view. Pneumonia, going on to disorganisation of the lung, may arise, proceed, and even prove fatal, without any of the symptoms which ordinarily announce that disorder: without notable cough, or obvious dyspnœa, or complaint of pain, or the expectoration proper to pneumonia. And the same is true of other inflammations. We discover, with surprise and horror, the traces of their operation, when we come to examine our patient's dead body.

This is a most important form of inflammation; for though it does not declare itself to ordinary observation, neither does it occur absolutely without symptoms; but it requires that the symptoms should be *looked for*. The *auscultatory* signs of pneumonia, all those symptoms which are furnished by the physical condition of the affected organ, are present, and speak as clearly as in the more flagrant cases.

Latent inflammation is apt to creep on during the progress of certain disorders, whereby it is modified and masked. It belongs to those states of the system in which the sensibility is dull, and the vital powers languid. In continued fever not only have I known the lung pass into suppuration, when the existence of pneumonia has been unsuspected; but I even have seen one case in which that usually torturing accident, perforation of the bowel, took place, with the escape of its contents into the cavity of the abdomen, and extensive peritonitis—yet the patient expressed no sense of pain, and the inflammation was revealed, while he continued to live, by no intelligible symptom.

Inflammation of this insidious and lurking character is most to be apprehended in the aged, in those who are habitually intemperate, and in persons of sluggish temperament. It sometimes occurs during convalescence from acute diseases.

Besides the varieties in degree which have been mentioned, there *are* also differences in *kind* among inflammations. What I have been speaking of during the preceding lectures I have called common inflammation. It is the *most common* form in which that process displays itself. All persons are liable to it; and that again and again. None are at any time privileged from its attacks. But there are several forms of inflammation different from this, which are called *specific*. There are various forms of specific inflammation affecting the skin, discriminated from each other by the local appearances they exhibit, and by the constitutional disorder which attends them. The rash and the fever of measles are very unlike the rash and the fever of scarlet fever; and both differ remarkably from those of small-pox, the eruption of which consists of little phlegmons. For the production of each of these diseases the application of a specific poison is requisite: and whereas common inflammation has a tendency, when once it has happened, to happen in the same part again—to *recur*—these forms of specific and contagious inflammation never, or almost never, occur more than once.

There is again the gouty inflammation—differing from common inflammation in several signal respects; in the production of chalk-stones; in its attacking those who are descended from ancestors who have had the disease, and scarcely any others. Then there is rheumatic inflammation, cousin-german to the gouty, yet distinguishable from it. And another variety of inflammation is that which arises from the introduction of the syphilitic poison into the system.

Of the specific forms of inflammation now adverted to I shall speak when I come to consider gout and rheumatism, and the contagious exanthemata, as distinct diseases. But there is one variety of inflammation—I mean the *scrofulous*—which meets us on every side; and is apt to affect so many parts of the body, and so great a number of persons; and has so fatal a tendency in many cases; that it cannot be left out of the account that I have been desirous to give you of inflammation in general.

Scrofulous or strumous inflammation (for struma and scrofula are convertible terms) is a *slow* process; it falls therefore within the class of *chronic* inflammations. It is not attended with much pain, or heat, nor for some time with much change of colour; and the redness which does accompany it has often a livid or purplish tinge.

These, however, are the negative properties of merely chronic inflammation. But *suppuration* at length occurs, which also lasts long: and the pus formed is peculiar and characteristic; and by no means laudable. It is not homogeneous or smooth, but consists partly of a thin serous whey-like fluid, and partly of fragments of a substance resembling curd: and the ulceration that ensues is marked by corresponding peculiarities. The ulcers are indolent; show but little disposition to heal. Scrofulous inflammation, compared with common, or what is called healthy inflammation, is in general but little influenced by remedies.

Besides this scrofulous *inflammation*, it is necessary that I should here direct your attention to another form of disease, which is likewise often spoken of as scrofulous. It is marked by the appearance, in various parts of the body, of what are called *tubercles*. These tubercles are masses of unorganised matter—somewhat resembling also curd or new cheese; but of various shapes, sizes, and consistence. They suffer gradual changes; soften or break down; undergo a sort of suppuration; and the characters of the softer matter into which they thus (as it were) melt, are exactly like those presented by the pus of a scrofulous ulcer or abscess. Mr. Paget states his belief that there are no signs, microscopic or other, 'by which degenerate lymph or pus may be with certainty distinguished from ordinary tuberculous matter.'

Now *tubercles* and scrofulous *inflammation* occur very frequently in the *same individuals*: and taking them together, as merely different forms of one and the same disease, it is remarkable that, although they affect a very large portion of the whole human race, and conduce more often and more surely than any other single thing in the catalogue of diseases to shorten the natural period of human life, they yet belong, almost exclusively, to certain *classes* of persons. We can tell, beforehand, that such and such persons are likely to become affected with scrofulous inflammation, or with tubercles: and we say of those persons that they have the scrofulous *diathesis*. I will not affirm positively that these forms of disease *cannot* be produced in any or in all persons; but thus much is certain—that some persons are particularly prone to them: fall into them as it were spontaneously; or on the operation of very slight external causes; and even when all possible care is taken to prevent the operation of every ascertained cause; while other persons never show *any tendency* to scrofulous or tubercular disease, even when continually exposed in the same way as the former: or if they do become subject to such disease at all, it is only when the external influences most favourable to its production have been intense in degree, and protracted in their application.

The occurrence of scrofulous *inflammation* in various parts constitutes distinct diseases; and the occurrence of *tubercles* in various organs, constitutes *other* diseases. It will facilitate our future enquiries into these several diseases, if I take this opportunity of telling you what has been ascertained respecting the habit of body with which they are associated, and respecting the pathology of tubercles, generally.

And first of tubercles.

In general they have been loosely described as being *roundish* masses of firm but friable matter, gray and semi-transparent, or yellowish and opaque, deposited in various parts of the body. Laennec, who paid great attention to tubercles, states that they are, at first, small, firm, grayish, semi-transparent bodies, which gradually enlarge and become opaque. In that condition he calls them *crude* tubercles. At length, after an indefinite period, these crude tubercles begin to grow soft in their centres, and are by degrees converted each into a liquid mass, having the consistence of cream.

Andral, another great authority, says that tubercles are, in the outset, small, round, opaque, yellowish bodies, unorganised, and of various degrees of consistence. He ascribes their softening (not to any spontaneous changes in their central parts, but) to the admixture of pus, poured out by the textures immediately surrounding the tubercle; which has irritated and inflamed those textures as any *other foreign body* might.

Rokitansky, again, holds that these gray and yellow tubercles, instead of representing two stages of the same disease, are from the first, and always, different substances; no transformation of the gray into the yellow matter ever taking place.

Here you have specimens of a conflict of opinions among men of much weight and eminence as pathologists.

Since the microscope has been brought to such perfection, and so much employed, and especially since the cellular pathology has prevailed in our schools, men have endeavoured to penetrate beyond the grosser phenomena of tubercular disease, and to pry into the very genesis and birth of the tubercle itself. But they have not been very successful. At least, there is a puzzling discrepancy of opinion even among the most modern enquirers into this subject. The matter of tubercle is variously described as a degraded condition of the nutritive material of the body, a morbid deposit from the blood, an exudation, a growth, a retrograde metamorphosis of pre-existing structure.

Shunning these perplexities, I shall be content to follow, as heretofore, our distinguished countryman, the late Sir Robert Carswell, the first Professor of Pathological Anatomy in University College; who, though not one of the latest, nor a microscopic, is, as I think, for all practical purposes, one of the most satisfactory writers on the subject. His opinions were formed after long and careful examination, for himself, of the parts infested by these tubercles. He devoted several years to the study of morbid anatomy, in Paris, where he made a very large collection of drawings, in which various diseased appearances are beautifully and doubtless faithfully delineated. Some of these he published. I show you enlarged copies of those which relate to tubercle. They bear out certain opinions which are stated in the letterpress that accompanies them, and which were at that time novel.

After all, the points in question possess more of curious interest than of practical importance. But as you cannot help forming some notions respecting them, I think myself bound to lay before you those which most recommend themselves to my own understanding. At the same time, you will take notice that I do not vouch for their absolute correctness.

Tubercles, then—or rather tubercular matter—is deposited, according to Carswell, from the blood. Whether it is something totally new, something foreign to the natural materials of the body, introduced into the blood from without—or whether, as seems more likely, it is the result of some defect or error in the due elaboration of the blood itself—he does not discuss. If, as has been supposed, the deposit be at first fluid, it afterwards becomes firmer, through the absorption of its more watery particles; and there then remains a 'pale yellow or yellowish gray, opaque, unorganised substance.' This tubercular matter, so deposited, does not always assume a round form: far from it; the shape in which it appears depends upon the nature of the part wherein it is planted. It used to be held that the tubercular matter was always laid down in the areolar tissue. But Sir R. Carswell asserts that its most favourite seat (if one may so speak) is *the free surface of mucous membranes.* In this category he includes the surface of the pulmonary air-cells. Let me tell you, parenthetically, that the tendency of more recent thought is to plant the disease in the *lymphatic* system of vessels. In whatever organ it is met with, if mucous tissue enter into the composition of that organ, that particular tissue is either (Carswell says) exclusively affected, or much more extensively affected than any of the other component tissues. These remarks apply to the lungs, the alimentary canal, the liver, the urinary organs, and the organs of generation; but the presence of the tubercular matter is much more easily detected in the mucous tissue of some of these organs than in that of others. It is very conspicuous in the fallopian tubes and uterus.

But tubercular matter is often found upon serous surfaces also; among which Carswell reckons the plates of the areolar tissue. It is even to be seen sometimes in the blood itself: not indeed while it is yet retained in its proper vessels, but when it is collected in the cells of the spleen. You know that the spongy texture of that organ allows the blood to accumulate in it in considerable quantity: and the tubercular matter may be seen forming in the blood at some distance from the walls of the cells in which the blood is contained. In one cell, Carswell says, you may perceive simply the blood coagulated: in another, it may be coagulated and deprived of its colouring matter: and in another, converted into a mass of solid fibrin, having in its centre a small nodule of tubercular matter.

Now when a speck or morsel of tubercular matter has been anywhere deposited, it is liable to increase. It grows larger by continued accretion; not by any out-growth, but by additional deposits upon its surface. This being the case, we see plainly enough how it happens that tubercles assume different shapes, according as they occur in different parts. The round form which is so often observed is purely accidental. When a tubercle is deposited in the substance of the brain—and becomes larger by the repeated accession of fresh tubercular matter upon and around it—it naturally takes a spherical form, because there is nothing to limit its enlargement, except the soft cerebral matter itself, which presses it with equal force on every side. For the same reason tubercles deposited in the *areolar* tissue are globular. In like manner, if tubercular matter be laid down in one of the pulmonary vesicles, so as to fill it up, it exhibits the roundish form of the vesicle. When it fills the cavity of a mucous follicle, it has a similar figure. But in the smaller bronchi it takes a more cylindrical arrangement. When (as often happens) it occupies one of these tubes, and also all the air-cells to which that tube leads, then we have twigs of tubercular matter, with cauliflower terminations. You see this depicted in the drawings before you. These statements are in close conformity with those contained in Mr. Rainey's essay 'On the Minute Structure of the Lungs,' published in the 'Medico-Chirurgical Transactions.' In the cavity of the uterus, and the fallopian tubes; in the infundibula and pelvis of the kidney, and in the ureters; and in the lacteal and lymphatic vessels; the tubercular matter is moulded to the forms of these parts respectively. We are more in the habit of examining tubercles in the lungs than anywhere else: and you will observe that in making sections of these organs, and looking only at the surfaces of those sections, we may easily overlook the branch-like disposition of the tubercular matter in the smaller bronchial tubes. We see the transverse section only of the tubes, which is necessarily more or less circular. On the surfaces of serous membranes, whether natural or adventitious, the tubercular matter will assume a rounded, or a lamellated form, according as the morbid process in which it originates has taken place at separate points, or over a continuous surface.

If Carswell's theory be correct, no alteration can be expected to take place in the tubercular matter after once it has been deposited, except through the agency of the parts around it and in contact with it. It is neither organised, nor capable of organisation; and, consequently, no vital change in its consistence can originate in the tubercle itself. If any spontaneous change arise, it must be a chemical one: but such Carswell does not admit. He holds that the *appearance* of spontaneous central softening is deceptive; and he points out certain sources of the fallacy.

Take, for instance, the lungs; the morbid conditions of which were the most especial object of Laennec's investigations. The tubercular matter is effused (principally) upon the mucous surface: upon the interior of the air-cells, and of the bronchial tubes communicating with them. Yet it need not so accumulate as to *fill* these cavities; and it often does not; there is left a central vacuity, which contains mucus, or other secreted fluids: and if the lung be cut across under these circumstances, the divided air-vesicles will look like rings of tubercular matter grouped together; and each divided bronchial tube will present also the appearance of a tubercle, with a central depression, or soft central point. On the other hand, when the tubercular matter has completely filled and blocked up these cavities, both vesicles and bronchial tubes will look, when divided, like sections of round solid tubercles. These Laennec seems, in fact, to have regarded as *crude tubercles*: while he took the former appearances for tubercles which were beginning to soften in their centres.

But you sometimes find large masses of tubercular matter in the lungs, or elsewhere: and in these masses you see that the process of softening is going on at several points, within the mass, at the same time. How is this to be explained? Why these large masses are formed, in fact, by the aggregation of many smaller masses, which lying near each other, have coalesced as the deposit continued to increase: and the areolar and other tissues originally intervening between these coalescing masses at length suppurate; and by their suppuration, they soften, and gradually break down the tubercular matter which they enclose, and by which they are also enclosed. This is just the process by which tubercles are frequently expelled from the body. The tubercles increase till the surrounding parts take on inflammation, just as they might do if any foreign body exercised the same degree of pressure upon them. The inflammation thus excited is of the scrofulous kind; the thin pus which is thrown out pervades and loosens the tubercular matter; a process of ulceration goes on in the surrounding textures; and at length (supposing the lung to have been the seat of disease) the detritus of the tubercle is brought up, gradually, by coughing.

These processes—of softening, produced by surrounding inflammation, and of ultimate expulsion—may be regarded as a natural mode of cure. Such a cure is in truth sometimes accomplished. A scrofulous abscess forms in the glands of the neck: and pus and tubercular matter are discharged. At length the ulcer heals, and no trace of the diseased process remains, beyond a scar. The same thing takes place also in the lungs; and, if there have been only one or two masses of tubercle deposited, the patient may thus get quite well: but unfortunately, as the matter is extirpated from one part of the lung, it is apt to be multiplied in another, till at length we have death by hectic, and all its melancholy accompaniments.

But I am desirous of pointing out to you another way in which tubercular disease may be said to be cured by a natural process. And this also has been better described by Carswell than by any preceding writer. One form of scrofulous disease, common among children, is what is called 'tabes mesenterica.' Tabes and phthisis, the one a Latin and the other a Greek word, signify, I need scarcely tell you, the same thing: a wasting away, or a consuming: and phthisis is applied to the same disease in the chest, to which tabes is applied in the belly. The common English word is consumption; and we might very well speak of thoracic consumption and of abdominal consumption; but the technical name of the latter complaint is tabes mesenterica. This is not only a common but a very fatal disease in children and young persons. The glands of the mesentery enlarge and become charged with tubercular matter: but they very rarely suppurate. Their enlargement is commonly connected with tubercular disease and ulceration of the mucous follicles of the intestines; and the little patients die, because the lacteals are no longer able to take up from the food a sufficient supply of nutriment: they die starved. But some few do recover from tabes mesenterica. Carswell relates an interesting case in which such recovery took place, and in which he had an opportunity of examining the glands at a subsequent period. He says, 'The patient, who when a child had been affected with tabes mesenterica, and also with swellings of the cervical glands, some of which ulcerated, died at the age of 21, of inflammation of the uterus, seven days after delivery. Several of the mesenteric glands contained a dry cheesy matter, mixed with a chalky-looking substance; others were composed of a cretaceous substance; and a tumour, as large as a hen's egg, included within the folds of the peritoneum, and which appeared to be the remains of a large agglomerated mass of glands, was filled with a substance, resembling a mixture of putty and dried mortar, moistened with a small quantity of serosity. In the neck, and immediately beneath an old cicatrix in the skin, there were two glands containing in several points of their substance (which was otherwise healthy), small masses of hard cretaceous matter.'

Now what Carswell here saw in the mesentery and in the neck, is what sometimes occurs in other parts of the body: in the lungs; and particularly in the bronchial glands at their root, and about the bifurcation of the trachea. From these situations, the hard chalky matter left by the absorption of all the more watery part of the morbid deposit, and by the concretion of its earthy salts, is often coughed up. But it may remain, when the tubercles are few, and there is no tendency to their increase, for years, as an inert, and almost harmless mass.

I mentioned just now that the secretion or separation of the matter of tubercle from the blood takes place, by preference, upon the free surface of mucous membranes, and very frequently also upon the surface of serous tissues, including the areolar.

It may not be uninteresting to enquire into the relative frequency of tubercular disease in different organs, or in different parts of the same organ. The facts which we possess on this head afford us very valuable assistance sometimes in respect of diagnosis.

During the periods of childhood and of youth, the lymphatic glands are exceedingly prone to scrofulous inflammation; especially the mesenteric and the cervical glands. Those of the groin and those of the axilla are rarely so affected. But in adult age tubercles are, beyond all comparison, most frequent in the *respiratory organs*; and they occupy the summit of the lung much more commonly and thickly than any other part. The superior and posterior portion of the upper lobe is the spot in which, if any tubercles at all exist in the lung, they are almost sure to be found. It is here also that they first begin to suppurate or soften. This law has long been well known: and so constant is it, that Carswell holds the formation of tubercles in any other portions of the lung to be always of secondary occurrence. He declares it to be the result of his experience (and few persons could have had more opportunities of examining diseased lungs), that there is no deviation from this rule, except when some other portion of the lung may have been the seat of an inflammatory attack, which has determined the priority of tubercular disease in that portion. We shall see hereafter what a very important bearing a knowledge of this law has, in settling the nature of a complaint which might, without it, be doubtful.

Scrofulous ulceration of the larynx, or trachea, when it occurs, is usually the concomitant of tubercular deposits in the lungs.

Next, tubercular or strumous disease is exceedingly common in the digestive organs: most of all in the mucous follicles of the small intestines; both in those follicles which are separate, and are called glandulæ solitariæ; and in those which are collected into roundish or oblong groups, the glandulæ agminatæ. It is secondarily to these affections of the follicles, in many cases at least, that the glands of the mesentery become implicated. Tubercular deposits are frequent also in the solitary glands belonging to the cæcum. The ulceration which follows the evacuation of the strumous matter from these parts gives the interior of the bowel an appearance somewhat resembling that of a moth-eaten garment. Tubercular matter is seldom deposited in any other parts of the intestines, great or small, than those which I have mentioned. Carswell supposes that it may often be secreted upon the free surface of the membrane, but that, not being entangled or confined in any mucous crypt, it is removed as soon as it forms. It is not often that scrofulous tubercles are found in the liver of an adult: they are not very uncommon in that organ in children, but even then the tubercles are few in number and small in size. It is a curious fact that they are much more frequently seen in the spleen also in children, than in grown-up persons. The uterus, the testicle, the prostate gland, are all liable to them: they are common enough upon the surface of the peritoneum.

In the nervous system tubercles are by no means unfrequent: they are met with oftener in the brain than in the spinal cord. That fearful disorder of childhood, known by the name of hydrocephalus, occurs principally, if not altogether, in connection with the scrofulous diathesis.

Strumous deposits are rare in the organs of circulation. Tubercles have been seen, I believe, in the muscular substance of the heart: but this must be a very uncommon thing. Scrofulous disease is not at all unfrequent in bone, especially in the bodies of the vertebræ, and in the spongy extremities of the long bones.

It is very seldom indeed that scrofulous tubercles occur in any one organ only. Almost always they are met with in at least two, and frequently in all the parts at once which are liable to be infested by them. Sometimes the lungs alone are affected; but generally both the lungs and the intestines are occupied by the disease. It has been affirmed by a great pathologist, M. Louis, that if you find tubercles in any other organ, you are sure to find them also, and in greater number, and further advanced, in the lungs. But this, though true as a general rule, is not without exceptions. I have seen the peritoneum crowded with myriads of these tubercles, when the most careful examination could not detect a single one in the lungs. And similar examples had fallen under Carswell's observation.

The question has been much and eagerly discussed, whether the deposition of tubercular matter be not, what I should call, an *event* of inflammation. Some persons have strenuously argued that the curd-like substance is nothing more than a particular kind of vitiated or imperfect lymph, and that it is never poured out except as a consequence of inflammation; and they cite cases of patients who always had enjoyed good health, until inflammation was accidentally excited in their lungs; immediately after which the well-known signs of phthisis began to display themselves; and, after death, the lungs were found full of tubercles. But they forget to take into the account another fact equally well established, viz., that tubercles are found, in great abundance, in the lungs of persons who were never known, in their lives, to have had any, even functional, disturbance of those organs; and whose lungs present, after death, no other traces of having been inflamed. We even find tubercles in the lungs of unborn children. Not that this is conclusive; for inflammation does sometimes attack the fœtus in utero, and leave permanent and unequivocal traces of its action.

Moreover, inflammation continually happens, in all the component textures of the lung, in the forms of bronchitis, pneumonia, and pleurisy, without the subsequent development of tubercles. I admit that this fact, to be of weight, should be proved of persons who possess the scrofulous diathesis; and I believe the proof might be found: but the search for it would require much carefulness and candour.

In my own opinion, there is not a shadow of evidence to show that the deposit of tubercular matter is always and necessarily preceded by inflammation. Yet an undoubted and most important *connection* obtains between the occurrence of inflammation and the occurrence of tubercles. Tubercles will cause inflammation, and inflammation will determine the development of tubercles. The enlarging tubercles excite inflammation in the surrounding textures by the pressure they exert upon them; and probably in other ways; by mechanically interfering with the healthy circulation of the blood, for example: and the inflammation lit up is usually of the scrofulous kind; it is slow, and partial, and easily *quieted* by treatment, though scarcely to be *cured*. On the other hand, there are numerous facts to prove that, in a person having the scrofulous diathesis, the occurrence of inflammation within the chest may rouse that previously dormant tendency into action, and become the exciting cause of the secretion or separation of tubercular matter from the blood. The cases in which parts of the lung other than the apex are found exclusively occupied with tubercles, are also cases in which, apparently, the same parts had been the seat of inflammatory action: of which we sometimes see other traces, in adhesions of the neighbouring pleura.

The connection between tubercles and inflammation is shown also by their occurrence in the substance of false membranes. And the same phenomenon marks the fact that they are something distinct and different from coagulable lymph.

You must not suppose, from anything I have said, that persons of the scrofulous habit are not susceptible of *common* inflammation: we know that they are, by the readiness with which slight injuries often heal in such persons; but there is always much reason to apprehend that inflammation occurring in them will take on the scrofulous form; become chronic, if it were not so at first, suppurate tardily, and produce that unhealthy kind of puriform secretion which is characteristic of strumous disease.

A question of vast moment in relation to tubercular diseases is, whether they are *contagious*: capable, *i.e.*, of being communicated from one individual to another. The general belief, in this country, is that they are not. Indeed, their very dependence upon a peculiar diathesis would seem to disprove the supposition. Yet some practitioners, even here, have, I know, misgivings on the subject; and in some parts of the Continent, in Italy particularly, consumptive patients are shunned, from the persuasion that their complaint is infectious. The solution of this and of some kindred questions of great pathological interest, though affording as yet but small promise of much practical value, has lately been attempted by inoculating the bodies of animals with tubercular matter. Without going into detail, I may tell you that in guinea pigs, and in rabbits, what seemed to be tubercle, in the very parts and organs in which that disease is found relatively frequent in man, was produced by the subcutaneous inoculation of tubercular granulations, of putrid muscle not tubercular, of vaccine lymph, nay, by the mere insertion of a seton, of a piece of cotton thread, and even of a small silver suture-wire.

Two observations only I venture to make in respect of these experiments.

First. They disclosed this curious fact, that different species of animals, and different animals of the same species, rabbits as compared with guinea pigs, and guinea pigs as compared with one another, possess different susceptibilities of receiving disease of this kind in this way. This fact illustrates, I think, the doctrine, that a special habit of body is well nigh if not absolutely requisite for the occurrence of tubercular disease in the human animal.

Secondly. Should the possibility of producing genuine tubercular disease in man, by the inoculation of tubercular matter, be ultimately established, that fact would have but little practical bearing upon the question of the contagiousness of consumptive disease—a question always, I repeat, of enormous interest. It would mark indeed some analogy between tubercular and certain other diseases—syphilis, for example—and leave us free from all risk and dread of any communication of disease from person to person, except by direct inoculation, as completely in the one case as in the other.

But this question of contagion I must revive when I come to speak hereafter of pulmonary phthisis.

Taking scrofulous inflammation and tubercle as different manifestations of the same kind of malady, I have been using, I am not sure with what propriety, the words *scrofulous* and *tubercular* indiscriminately, as though they were convertible terms. But the opinion has, I think, been steadily gaining ground, that however much they may have in common, however near and striking their affinities, the two spring in reality from different, though often closely interwoven, roots: that as there surely is a constitutional tendency to the scrofulous sort of inflammation, discernible in a certain class of persons even before the actual occurrence in them of any such inflammation, in short a scrofulous *diathesis*; so there is, distinct from this, a *tubercular* diathesis, which also may often be recognised where as yet there has arisen no evidence of tubercular disease.

Now, the physical and moral characters by which these tendencies respectively reveal themselves to careful observation, even in early life, are believed to be of this kind.

The persons who bear the scrofulous stamp—in whom scrofulous disease is *most* apt to declare itself, are marked, during childhood, by pale and pasty complexions, large heads, straight and scanty hair, narrow chests, protuberant bellies, large wrists and ancles, soft and flabby muscles, and a languid and feeble circulation. They are slow of apprehension, slow also in their movements. They present many of the features belonging to that pattern of body which is denominated the leucophlegmatic. The disposition to scrofula is frequent also, though less common, in conjunction with the melancholic or bilious temperament; in persons of dark muddy complexion and harsh skin; in whom, too, the mental and bodily energies are sluggish and dull. And it is remarked that in persons of this cast, scrofula, when it does occur, is even more than usually obstinate and intractable.

Scrofula does often indeed appear in persons who exhibit none of those signs of a strumous disposition which I have been enumerating; but it is *more likely* to appear, *cœteris paribus*, where those signs *are* observed.

On the other hand, the tendency to tubercle is said to be more often inherent in persons who present in their pattern of body a variety of the sanguine temperament; and to be indicated by light-coloured or red hair, gray or blue eyes, with large sluggish pupils and long silky lashes, a fair, transparent brilliancy of skin, and rosy cheeks. This red colour, which is well defined in general, is easily changed, however, by cold, to purple or livid; the skin is thin and readily irritated; the sclerotic has often a peculiar pearly lustre, and the feet and hands are subject to chilblains. Children of this type are, many of them, extremely clever, forward, and ready of apprehension, of eager tempers, and warm affections, lively, ardent, imaginative, impatient, and susceptible. This precocity of mind and intellect, while it delights the fondness of the parent, awakens the fears of the more far-seeing physician.

If these distinctions be well founded, as I incline to think they are, while you bear them in mind, and help by your own future observation to confirm, and more strictly define them, you must not forget that the two forms of disease intermix continually. You will find tubercles engrafted in scrofulous persons; and scrofulous mischief in those who bear the outward indications, and the inward reality, of tubercular disease. Yet though they so often co-exist, either may exist without the other. Of the two (if two they be) the scrofulous diathesis has probably, as Mr. Paget has observed, the wider range and the larger import.

There are several alleged marks of a scrofulous *diathesis*, which are, in fact, instances of scrofulous *disease*. Such, for example, is that chronic lippitudo, which so frequently disfigures strumous children, rendering them what is called blear-eyed: and chronic inflammation of the conjunctiva, lasting long, without much redness or heat, and with extreme impatience of light, and a tendency to the formation of little pustules near the edge of the cornea. The tumid and chapped upper lip; the redness and swelling of the columna nasi, and lower parts of the nostrils, so common in children, especially during winter, are early fruits of the strumous taint. Certain maladies of the joints, what are popularly called white swellings, are instances of scrofulous disease. So may perhaps rickets be considered; at any rate, ricketty children are very often affected with scrofula also. Moist eruptions behind the ears; chronic enlargement of the glands of the neck, consequent often upon such eruptions;

that slow, eating, ulceration of the nares, termed lupus; may all be included within the class of strumous disorders.

When any one of these scrofulous affections has once shown itself in any person, we know, by that circumstance, that he possesses the strumous constitution; and we look for the recurrence of his complaint in the same part, or in other parts.

Are these tendencies to disease—these diatheses—inherited? That they are so can scarcely be doubted; and being so, the diseases which spring out of them must also be counted as hereditary. We suspect or infer the fatal tendency in some persons from knowing that scrofula or tubercle has affected their progenitors. I have seen lungs, taken from the body of a fœtus, stuffed with tubercles. There were some fine examples of this in Mr. Langstaff's museum, in the city. We have here, therefore, the rare conjunction of congenital disease, and hereditary disposition. I need not repeat the remarks I made before, respecting hereditary diseases in general. No one, of the least observation, can doubt that the disposition to consumption is very often transmitted from parent to child. We see whole families swept away by its ravages. Like other hereditary tendencies, it may skip over one or two generations, and reappear in the next, just as family likenesses are known to do. There are other families in which you can trace no such predisposition; but such families are perhaps few. A little leaven is sufficient, sometimes, effectually to taint a whole pedigree. The tendency, however, exists in various degrees. It may be so strong that no care, no favourable combination of circumstances, will prevent its local manifestation; and it may be so faint that it would never break out into actual mischief if the exciting causes of scrofulous and tubercular disease could be warded off. It is important, therefore, to know what these *exciting causes* are.

'They may all be ranked together (to use the language of Dr. Alison) as causes of *debility*, acting permanently, or habitually for a length of time, although not so powerfully as to produce sudden or violent effects.'

The circumstances to which, acting separately or in combination, we most confidently ascribe the power of developing scrofula, or evoking tubercle, are insufficient nutriment, exposure to wet and cold, impurity of the atmosphere, the want of natural exercise, and mental disquietude. To estimate the separate effect of each of these causes may be difficult; but their combined influence is unquestionable.

There can be no doubt that improper diet, or rather imperfect nourishment, is one main exciting cause of scrofulous disease. Yet of this it is not an easy thing to obtain evidence, which shall be entirely free from fallacy. Such disease occurs very often among the poor; but then it very often occurs also in the families of the rich. There is one fact which has always struck me as very instructive and convincing on this point. Infants at the breast, supplied with good milk, and with plenty of it, seldom show any signs of scrofulous disorder: whereas, as soon as they are weaned, they become subject to various complaints of a strumous kind. When an unweaned child is brought to us with ophthalmia, we expect almost always to discover inflammation of the common and acute kind; the purulent eye. In nine children out of ten who come after weaning, we look for and find some form of scrofulous inflammation, such as pustular ophthalmia.

The greater prevalence of scrofulous disease among the poor may be ascribed, in great measure, to their frequent exposure to wet and cold. Scrofula seldom breaks out in the mild and dry weather of summer. The influence of climate in fostering or repressing tubercular disease is notorious. There is no climate in which it flourishes more than in our own. Consumption is called, in some parts of the continent, the English disease. Persons who migrate from this country to warmer and more equable climates, seldom become scrofulous; nay, it very often happens that the incipient indications of strumous disease are completely arrested or quieted by the change. Phthisical patients, much troubled by symptoms here, are sometimes so thoroughly freed from them soon after their arrival in Madeira, as to be deceived into the belief that their case had been mistaken. They think themselves well. A return to this country undeceives them. The native inhabitants of hot regions are by no means, however, exempt from struma, in any of its forms. When they come into these latitudes they are more subject to scrofula than we ourselves are. And the same effect of climate is very distinctly visible in the lower animals. The physician in ordinary to the inmates of the Zoological Gardens will tell you that the beasts and birds which are brought hither from warm latitudes perish in great numbers from scrofulous diseases. John Hunter observed this long ago in respect of monkeys.

Of the debilitating influence of impure air I spoke in a previous lecture. That it promotes the evolution of scrofulous disorders we have proof, on a large scale, in the great mortality produced by such disorders among the lower classes, in large cities as compared with agricultural districts. The per-centage of deaths from consumption, hydrocephalus, and various other diseases which spring from a strumous habit, is much greater in London than in the country. Even in individual cases this influence is too manifest to be overlooked or mistaken. It is impossible to question the beneficial effect, upon children afflicted with scrofula, of a removal from London to the sea-coast.

Soil again is a most important element in this deeply interesting question. It would be difficult to over-rate the value of the momentous fact quite recently established by Dr. Buchanan, that 'wetness of soil is a cause of phthisis to the population living upon it.'

I said, when I first begun to speak to you of inflammation, that it was the only disease which we were able to excite at will: that we could cause inflammation, in various ways, whenever we desired to do so; but that to make a cancer or a tubercle was beyond our power. With all deference to the inoculators, I hold that in the practical meaning of these words, this assertion is quite true—true in respect of *exciting* causes—true also in respect of *predisposing* causes. The latter of these propositions has, however, been denied, and experiments have been appealed to in disproof of its correctness. It has been said that, by so arranging external influences as to heighten and concentrate their hurtful tendencies, tubercular disease may, in the lower animals at least, be engendered. It has been affirmed that tubercles may be produced at will in the liver of a rabbit, by shutting the animal up in a cold, damp, dark, and narrow place, and feeding it upon food not natural or suited to it. Mr. Simon has shown the strong probability that all such experiments have been fallacious. A liver occupied with so-called tubercles, thus produced, was brought to him for examination. He found that the supposed tubercles were really minute oblong eggs, or larvæ, of some entozoon. He then made many experiments himself, to try if he could create tubercle artificially. He dissected also many rabbits on which no experiments had been made. The result was, that he never saw tubercle in a rabbit, until at a later period he succeeded, not in *creating* by outward influences, but in *transmitting* tubercle, or what, to skilled eyes, appeared to be tubercle—from man to rabbits, and then by a second transference from rabbit to rabbit—by *inoculation*.

We are not without strong evidence upon this important point, even as it respects the human animal. On former occasions I have been in the habit of quoting to you the following statement, which I had read in the 'Westminster Review':—'According to the very trustworthy report of Dr. Schleisner, who was sent by the Danish Government a few years since to investigate the sanitary condition of Iceland, no combination of what are commonly accounted the predisposing causes of consumption and scrofula could be more complete than that which exists among the mass of the Icelandic peasantry. Whole families are huddled up with their sheep, not only during the night but during the greater part of the day, for half the year, in most miserable hovels, destitute of any ventilation but that afforded by the chimney. Their clothing is not once put off or changed during the whole of that time; their food is scanty; and the external atmosphere is both cold and damp. The unhealthy condition of the population is evidenced by its extraordinary liability to epidemic disorders; and by its want of increase, or even in some districts by its absolute diminution. And yet amongst this remarkable people, the best-educated peasantry in Europe so far as regards what is commonly accounted education, scrofula and consumption are unknown.'

This statement, the accuracy of which had been called in question, has very recently been confirmed by unimpeachable testimony, zealously collected and made public by Dr. Leared.

In a letter written to him upon the subject, Dr. Hjaltelin, a distinguished physician residing in Reykjavik, declares that during a period of fifteen years he has had more than thirty thousand patients, and has made numerous autopsies, yet not a single case of tubercle of the lungs, or of indigenous consumption, has he met with. He adds the corroborative evidence of Dr. Skaptason, the oldest and most experienced physician in Iceland, who says: 'During my thirty-two years' practice in this country I have not seen a single case of phthisis tuberculosa. I have seen a great many cases of other diseases of the lungs, but phthisis tuberculosa never. In all the autopsies I have made, I have never observed the least trace of tubercles in the lungs.'

The writer in the 'Westminster Review' ascribes this immunity 'to the highly oleaginous nature of their diet, which consists in great part of the oily bodies of piscivorous birds.' A more likely cause, to my mind, for such immunity, if it really exist in that race of men, is their probable exemption from the scrofulous *diathesis.* The same may be said respecting 'the almost complete exemption (as stated by the late Dr. W. P. Alison, doubtless, on good authority) of the inhabitants of the Feröe Islands from tubercular disease, notwithstanding that their climate, as regards cold and damp, is exactly that which, in this country, has been thought most favourable to it.'

Of course, no experiments like those practised upon the rabbits can be purposely made upon a healthy man; but accidental opportunities arise of witnessing, even in this country, an approach to a similar trial of the human species. Instances are recorded of persons, previously well (but having doubtless the strumous diathesis), becoming affected with scrofula after being confined in the dungeons of a prison, and there scantily fed.

Something of this kind I have myself had the opportunity of noticing.

A number of male prisoners, chiefly young men, began to show glandular swellings of the neck, after incarceration for some length of time in the Penitentiary at Milbank. The circumstances of their health led to a relaxation of their punishment. Instead of being kept in solitary confinement in a coldish cell, and on the prison diet, they were permitted to work, for several hours daily, in each other's company, in the garden of the edifice. Some porter was at the same time given them to drink, and their allowance of meat was increased. The improvement in their condition was rapid and striking. Here we have the disorder germinating under one state of external circumstances, and checked immediately under the opposite state.

If you consider the way of life of the children of the poorer classes in this metropolis, and in our large manufacturing towns, you will find that they are much exposed to most of those injurious influences, the combination of which has been thought likely to generate tubercles. They live usually in an atmosphere made stagnant by narrow streets; and in small, crowded, ill-ventilated, and dark rooms in those narrow streets. The stagnant atmosphere is contaminated in a thousand ways. They are very insufficiently protected from transitions of temperature, against cold and wet, by their clothing. They are commonly ill fed—their diet being frequently scanty, and generally of a kind quite unsuited to their growing years. We need not be surprised, therefore, at the ravages which scrofula, in its manifold shapes, makes among the children of the poor in large and populous towns. If ever scrofula be generated, in this country, independently of any hereditary strumous taint in the constitution, it is in them. But in most cases I believe it is the latent disposition that is called into action. Moderate exercise, in pure and dry air, and in the open day-light, with suitable nourishment, sufficient clothing, and attention to the state of the bowels: these circumstances comprise nearly all that we can attempt, in a given climate, towards preventing the development of struma: and from each and all of them many of these poor children are habitually debarred.

LECTURE XIII.

Cancer: its Varieties. Scirrhus; Medullary Cancer; Epithelial Cancer; Osteoid Cancer. Its mode of Growth and Dissemination. Habitudes of the several Varieties. Question as to its Affinities. Treatment of Inflammation. Pre-requisite Regimen. Blood-letting. External Cold. External Warmth. Counter-irritation. Antimony. Opium.

I HAVE more than once coupled cancer and tubercle in the same sentence. Though very different in many respects, they are alike in their intractable character and destructive tendencies. Of the two, cancer, while it is happily much the more rare, is also much the more painful, loathsome, and hideous in its consequences. It is to cancerous diseases that the epithet *malignant* especially belongs; the malignancy consisting in their progressively destructive and incurable nature. Not resulting from any mere change in the natural textures of the body, but constituting an addition to them, and therefore assuming, usually, the shape of tumours, they are commonly and correctly spoken of as cancerous *growths.* But there are other growths which, by comparison, are *innocent*; which do not imply any necessary destruction of contiguous parts, nor any inevitable danger to life, nor even any marked deterioration of the general health. Such are certain fatty tumours, and fibrous tumours, and osseous tumours. All these last, as their names denote, resemble in their sensible qualities some one of the healthy and natural textures. They have accordingly been styled *analogous*, or *homologous* growths; while cancer and tubercle, which find no counterparts in the sound body, are said to be *heterologous.* Some varieties of cancer, however, as seen by the naked eye, look very like the pulpy substance of the brain, and are named after this resemblance. But although these cancerous growths are not simply misplaced or distorted forms of native textures, they always contain germinal materials, nucleated cells, and nuclei, resembling those through which all parts of the body are naturally constructed. They have their own nerves and blood-vessels also. They must be regarded, therefore, as the consequences of some aberration of the constructive vital forces, some fault of nutrition, and not as parasites, or things entirely foreign to the substance of the body. Of most of these cellular elements, as seen in cancers, the microscope has ascertained that they deviate sensibly from the cell-forms of healthy textures—are deformed in various ways, broadly oval, elongated, oat-shaped, tailed, with intermingled grumous or granular matter. They are often packed together in a confused and disorderly manner, unlike the trim and definite arrangements of health; and they are mixed with a dimly granular fluid which has obtained the name of *cancer-juice.*

By some pathologists, cancerous formations have been ascribed (very erroneously, in my opinion) to *inflammation* as their cause. I shall scarcely, therefore, be going out of my way if I state here some of the broad facts which have been ascertained upon this very interesting subject.

The various forms of cancer or carcinoma present among themselves very striking differences, and have received a puzzling multiplicity of names; scirrhus, stone cancer, medullary sarcoma, encephaloid or cerebriform disease, soft cancer, fungus hœmatodes, colloid or gum cancer, epithelioma, and several more. But I feel bound to adopt the titles and classification authorised by the 'Nomenclature of Diseases,' lately published, which comprises the following varieties. The physical characters of some of these varieties offer strong points, not merely of difference, but even of contrast.

Scirrhus, as that word implies, is remarkable, in its early stages, for its hardness. It is as firm as cartilage, and creaks when cut in two by a sharp knife. The surfaces exposed by its division present a glistening, satiny appearance, and a white, or gray, or bluish-white colour; and both surfaces are slightly concave. Athwart this grayish and semi-transparent substance run opaque intersecting bands, having a fibrous aspect. By strong pressure a thin juice may be made to ooze from a slice of the scirrhous tumour.

Medullary cancer, on the other hand, is remarkable for its softness. It is composed, in great measure, of a yielding, white, opaque, pulpy substance, having a smoothly lobed surface, and very closely resembling, both in colour and in consistence, the substance of the healthy brain. It is often called, accordingly, *encephaloid* cancer. This cerebriform pulp is traversed and circumscribed by fibrous septa, which are generally extremely thin and delicate. In both these varieties of cancerous growth, therefore, there is a contained and a containing element.

Epithelial cancer affects, in the first instance, some portion of the surfaces of the body, and involves mainly the papillæ of the skin, or of some mucous membrane. It shows a partiality, so to speak, for those parts where the skin and the mucous membranes are about to meet. It produces some swelling and deformity of the part, with commonly a granular, wart-like roughness; and the surface thus altered soon becomes moist, with a slight ichorous discharge, or is covered with a scab, or breaks out into ulceration. The cancer cells of this variety betray their affinity with the cells proper to the same part in health, are flat, and angular, and resemble, with a difference, the scales of what is called pavement epithelium.

Now, without going further in the list, you may well ask upon what principles structures so dissimilar in their physical appearance and character have been reckoned to belong to the same species of disease? Why, for these reasons. They are all strictly destructive or malignant forms of disease. Although in any shape they are of somewhat rare occurrence, yet when they do occur, two, or more of the varieties are often found to coexist in different organs of the same individual; nay, in contiguous parts of the same organ. More than this: if a tumour consisting of one variety be amputated, and a fresh growth spring (as too often it does) from the same spot, this secondary growth is frequently of *another* variety. There can be no doubt that all are connected by some very intimate bond of union.

Of all of them it has been ascertained, by much and fatal experience, that occurring in any one part of the body they are prone to appear in various other parts; that they are commonly attended, during some part at least of their progress, with very severe and characteristic pain; that they are incontrollable by any known remedy; and tend always, sometimes slowly, sometimes with frightful rapidity, to augment in bulk; eating away contiguous parts by their invasion and pressure; breaking out, when near the surface, into foul and repulsive ulceration; producing often the most ghastly disfigurement; and ultimately destroying life. Sometimes vital parts are slowly disorganised by the corroding extension of these tumours; sometimes large blood-vessels are laid open, and death is suddenly brought about by hæmorrhage; and sometimes the powers of life sink gradually under the wearing influence of the disease, and that degeneracy of the blood which it causes or accompanies, or perhaps results from.

There is scarcely an organ or texture of the body which is not liable to be attacked by this terrible foe: the brain, the eye, the lip and face, the lungs, the stomach, the intestines, the liver, the kidneys, the breast, the womb, the testicle, the bones. But some parts are more often the seat of cancer than others. Among these may be reckoned the female mamma, the uterus, the stomach, the liver, and the testicle.

The mode in which cancer *originates* is uncertain; the modes in which it *spreads* and *multiplies* are better understood. An individual tumour may enlarge by the progressive insinuation of the cancerous matter into the interstices of the neighbouring tissues, which, thus fastening upon, it consolidates. The disease may be communicated, by imbibition, from one organ to another which is in mere contact with it: from the upper surface of the liver to the diaphragm for example; from one coil of bowel to another, or perhaps to more than one in the frequent shiftings of relative position among the intestines. But how does it come to occupy at the same time, or in quick succession, several separate and *distant* organs? This is a question of the greatest interest and importance, and it admits of a distinct reply.

Cancer often makes its appearance in a single spot near the surface of the body; in the female breast, for instance. We see and feel it there while it is yet small, and while the general health of the patient seems to be otherwise perfect. Gradually, the tumour enlarges, and enlarging it sends out branches which penetrate in various directions among and between the surrounding tissues, grasping them as it were, compressing them, holding them fast, so that the tumour becomes fixed, or moves only with their motion. This contractile property accounts for the slight concavity assumed by both the surfaces exposed when a schirrous tumour is cut across: it explains also a puckered appearance of the surface of the breast, and a characteristic pulling inwards of the nipple. We see the same tightening effect of the same disease in other parts, especially in the intestines, which are often narrowed as if tied by a string, and sometimes completely and fatally closed in this way. At length the tumour in the breast softens in some places; the glands of the axilla become swollen, hard, painful it may be, and filled sometimes with cancerous matter, carried thither, it may be assumed, by the lymphatics of the part; the tumour breaks perhaps through the skin, and presents the shocking spectacle of 'open cancer;' the general health gives way, and the skin assumes a peculiar straw-coloured tint. Though some of the cancerous matter is thrown off from the ulcerating surface, the disease spreads inwards from the base of the ulcer, by imbibition apparently, and devours the textures thus invaded. During this process, unless the patient dies prematurely, or the original disease is removed by a surgical operation, cancerous tumours form in one or in several of the internal organs, and give notice of their presence by appropriate symptoms. There is an original morbid growth, and there are subsequent morbid growths; a primary tumour, and secondary tumours; and the latter are *caused* by the former. This is a most important fact, if indeed it be true.

I have told you of the rudimental cell-forms, and nuclei, and granules which are to be detected by the microscope in all, or almost all, cancerous growths. It is by the increase of these elements; by the growth and evolution of young cells, which, in some instances, are included generation after generation within parent cells, that the original tumours enlarge and extend themselves; and it is by the transference of certain of these cells or granules, or of the mere cancer-juice, from the original tumour, that a crop of secondary tumours is sown in remote parts of the body. The cells, and probably the granules also, are endowed with a power of self-increase and propagation, wherever they find a fitting soil. Possessing, like the seeds of plants, an inherent vitality of their own, they merely require, in order to germinate, to be placed in contact with some living tissue, wherewith they may form vascular connexions, and wherefrom they may draw the materials of their nourishment. Cohering together, for the most part, with but little force, they are easily detached from the parent mass. It is matter of fact that the secondary tumours form most surely and most rapidly when the primary tumour is of a soft kind; and that when they succeed to scirrhus, it is after the process of softening has commenced in that originally hard structure. These germs are carried sometimes through the lymphatic vessels to absorbent glands in the vicinity of the primary growth; from a cancerous breast, for example, to the glands of the axilla; making their way, by the shortest road, towards the thoracic duct; but there can scarcely be a doubt that the *blood* is also one main channel by which the seeds of this dreadful malady are conveyed from its first to its subsequent sites, and thence perhaps, if life continue long enough, to tertiary locations. Mr. Paget relates a striking and conclusive instance of the transference of the disease from one organ to another. In a case of primary cancer of the liver, in which the growths were all tinted with bright yellow by the bile, he found numerous small cancerous masses of the same colour infiltrated in the lungs, and the small branches of the pulmonary arteries leading to them were filled with bright yellow substance, as if they had been minutely injected with chromate of lead. Doubtless, as he remarks, a similar transference often occurs, although it may seldom be so plainly traceable. The gross matter of cancer has sometimes been found in the veins that proceed from the primary tumour,—nay, in large venous trunks at a distance; so that some distinguished pathologists have too hastily conjectured that it may originate in the veins. You are perhaps aware that foreign substances, circulating with the blood, stop or are entangled more often in some organs than in others. Minute globules of mercury, when that metal has been introduced into the veins, are found strewed through the substance of the lungs, and of the liver. Pus, or impure animal matter received into the blood, is arrested, and forms scattered points of inflammation and abscess, in the same organs; and it is in the liver and the lungs that separate tumours of secondary cancer are most commonly met with. If this be the true theory of secondary cancerous formations, I need scarcely point out to you the urgent importance of the rule which prescribes to the surgeon the *most complete* extirpation of the primary tumour, *at the earliest possible period* of its existence.

The disseminated cancer-germs are not scattered to this organ or to that, to the lungs or to the liver, indiscriminately or by chance. Their distribution bears a certain relation, as you may readily conceive, to the situation of the primary disease. Since the blood, in its return from the stomach, the intestines, the rectum, passes through the portal system of veins before it reaches the lungs, you would expect that cancer-cells conveyed from those parts would be stopped in their journey through the capillary vessels of the liver—and it is so. A few, in rare instances, pass on to lodge and grow in the lungs. Again, the blood from the breast goes direct to the vena cava, and the lungs are the first to receive and entangle whatever seeds of disease it may carry: for what is true of cancer-germs is true of pus also, and of other morbid materials. The pulmonary capillaries, however, seem more easily permeable by such matters than the hepatic. Some of the germs pass through them, and enter the general circulation; and the liver, as well as the lungs, frequently becomes contaminated: and germs may thus settle in other parts. In these facts we see one reason why cancerous growths are more often met with in the liver than in any other organ of the body. Primary cancer of the kidney is, in like manner, apt to be disseminated through the medium of the vena cava; and we might expect that cancer-germs from the uterus would take the same course, and affect the lungs earlier and more often than the liver. But that is not always the case. The liver is liable to be secondarily affected from malignant disease of the womb; and Dr. Budd gives the explanation of this apparent anomaly. The rectum and the hæmorrhoidal veins, which return the blood to the *vena portæ*, very frequently become implicated in the uterine disorganisation. Fortunately, cancer of the uterus, which is a fearfully common disease, is not so often disseminated as cancer of the stomach, or of the mamma.

Encephaloid cancer, as compared with scirrhus, is abundantly furnished with blood-vessels: and upon this difference in their degree of vascularity other remarkable differences between the two varieties seem to depend. First, encephaloid tumours generally augment with much greater rapidity, and attain a much larger size, than scirrhous tumours. Occasionally their magnitude comes to be enormous. Again, cerebriform growths seldom happen singly, but occupy several organs of the body at once. Scirrhus, increasing slowly, occurs also in fewer sites; it is sometimes even solitary. More tissues, too, appear to be obnoxious to the soft than to the hard variety.

Now (as Dr. William Budd has well remarked) a large apparatus of blood-vessels, bringing a proportionally plentiful supply of nourishment to the encroaching tumour, accounts sufficiently for its rank and rapid growth; and the same condition, especially when conjoined with *softness* of the parent mass, affords obvious facilities for the liberal dissemination of its germs through numerous returning channels. In fact, the soft varieties alone have, as yet, been recognised in the veins.

The same multitude of its blood-vessels, and slender cohesion of its component parts, serve to explain another peculiarity of the cerebriform variety. Intermixed with, or diffused through, the brain-like substance, there is often to be seen a quantity of extravasated blood: and when the disease breaks out into ulceration, red, ragged, and *bleeding* growths, of fungous aspect, sprout rapidly from the open surface. To these *accidents* of cancer the term *fungus hœmatodes* is to be traced. We do not find scirrhus to be the seat of similar interstitial hæmorrhages.

And, belonging to these soft cancers, but not restricted to them, there is another accident—for so it seems to me, although in the 'Nomenclature' it constitutes a separate variety. The diseased mass is sometimes black, either through the whole or the greater part of its extent; or in spots and patches. It is stained, in fact, with a black pigment. And, in coincidence with this *melanotic* variety, sundry distant parts and tissues are often seen to be sprinkled more or less thickly with black spots or stains, but otherwise apparently unchanged. This fact, again, like the yellow masses in Mr. Paget's case, teach us how the cancer virus may, without our suspecting it, be largely dispersed throughout the body, where there are no visible or outward tokens of its presence. It is said that melanotic cancer is frequently met with, in conjunction with the epithelial disease, in the skin, in or near moles and nævi that have a similar black tint. It is not uncommon in the eye, where the choroid pigment is abundant; and it may, by transference, occur anywhere.

Of the *osteoid* variety I need say but little. It is less common than the others, and it is characterised, as its name imports, by an admixture of bone with matters plainly cancerous. Like the rest, it may be primary or secondary, and is capable of transference. Its primary seat is usually in some bone, and much more commonly than elsewhere, in the lower end of the thigh bone; but it sometimes originates in other tissues. Its growth is rapid and painful. It may occur interchangeably with any of the other varieties, but the interchange seems to be most frequent between it and the medullary form.

Of these several varieties of cancer, there are still some general habitudes with which I wish you to be acquainted.

The disease is common to all classes and ranks of life, from the lowest to the highest. The annals of our own and of a neighbouring nation tell of its visits to Royal and to Imperial houses, striking with the impartiality of pale death itself, —'æquo pede pauperum tabernas Regumque turres.'

From the tables contained in the reports of the Registrar-General, it would appear, however, that women are more subject to this fearful disorder than men, in the large ratio of five to two. It fixes chiefly on the organs of reproduction, the mammæ, the uterus, the testicle. These, and the stomach, are the most frequent seats of *primary* cancer; and in these same parts *secondary* cancer is comparatively rare. Probably, in the breast it is always primary.

The cancers that are least prone to increase by multiplication are the epithelial variety generally, and those (of whatever form) which affect the rectum, the womb, the urinary organs, and the brain.

The secondary formations are commonly of the encephaloid kind, whatever the primary form may have been, and the parts in which secondary cancers are most frequently found, are the lymphatic glands, the liver, the lungs, the bones.

The spinal cord, the tendons, the tonsils, the pharynx, the prostate gland, are among the parts that seem least obnoxious to the disease.

When medullary cancer occurs as primary, it is mostly in the eye, the testicle, or the bones.

Again, scirrhus cancer rarely shows itself in early life; its most common advent is between the fortieth and fiftieth year: whereas medullary cancer is met with much earlier than any other variety. It is almost the only form of cancerous disease that happens before the age of puberty. Epithelial cancer is uncommon before twenty.

The mortality from cancer, estimated with due reference to the whole number of persons existing at different ages, increases steadily as life advances.

Cancer, like tubercle, is a diathetic disease, occurring in some pedigrees only, and observing the laws of such inheritance. About the determining causes of its local manifestation very little is known. Its primary apparition often startles its victim in the midst of what seems to be the most perfect health. As the disorder advances, however, and, especially when secondary cancers have been superadded, the appearance of good health departs. The patient becomes sickly, weak, dejected, sallow, with a peculiar, and almost distinctive, though faint tinge of lemon-like yellowness in his skin. The blood is all the while deteriorating. It cannot but be altered by what the cancers in their growth take from it; and also, and much more, by what it receives from the cancers in the process of nutritive absorption. The cancerous diathesis furnishes the soil for local cancer; the local cancer, and its brood, confirm and deepen the cancerous diathesis. That diathesis gathers strength also by transmission. Mr. Paget tells me that in his experience, when the inheritance is traceable, cancer occurs earlier, nine times out of ten, in the progeny than in the progenitor.

Of cancer, as of tubercle, the question has been raised whether it can be communicated by inoculation; and, in reference to that question, experiments have been made upon some of the lower animals. But never, that I know of (except in one solitary instance reported by Langerbeck—which may have been simply a coincidence), has such engrafting given rise to any variety of cancer. No one, in fact, shuns to approach the disease, frightful and repulsive as it often is, through any fear of catching it.

Is it possible that cancer may be produced, in man, by some external cause? It has been noticed that epithelial cancer of the lip has frequently followed the long-continued use of a clay tobacco-pipe in smoking. The frequent contact of coal-soot has seemed to have the power of producing cancer. There is a form of the disease affecting the scrotum, and familiar to surgeons as the chimney-sweeper's cancer. A case is recorded by Mr. Pott of the same complaint on the right hand of a gardener who for years had been in the habit of sprinkling soot over his flower-beds with that hand.

Of all these cases the probable explanation is that the disease, breaking out in a person bearing the cancerous constitution, has its local habitation determined by some flaw or weakness of the part assailed. It fastens on a lip that has suffered chronic irritation from the habitual contact of a pipe—on an old scar—on a previously existing wart. Mr. Paget has informed me that the chimney-sweepers, who suffer thus, are almost all of them infested with warts in various parts of their bodies.

Great mental distress has been assigned as influential in hastening the development of cancerous disease, in persons already predisposed to it. In my long life of experience, I have so often noticed this sequence, that I cannot but think the imputation true; and if it be so, we accept again the same explanation. The body weakened, and its vitality lowered, by the worry of the mind, falls for that reason an easier and an earlier prey to the invading disease.

Once more, are there any affinities discernible between cancer and tubercle? It has been so fancied, but, as I think, upon very insufficient grounds. My friend Dr. Christison, any of whose opinions must command respectful attention, holds that 'malignant diseases are part of the unfortunate heritage of the strumous constitution.' The late Mr. Travers regarded encephaloid disease as cancer modified by a strumous constitution. Mr. Weedon Cooke states his belief that the 'two diseased products, cancer and tubercle, are interchangeable creations.' But the cancerous and the tubercular are different and distinct diatheses. Mr. Paget speaks of them as 'incompatible and mutually exclusive.' Whatever relations may exist between them are relations of antagonism. Tubercle and cancer rarely co-exist, and when they co-exist they never, or almost never, have been known to be in active progress at the same time. In 104 trustworthy narratives, including his own experience, of persons cut off by cancer, Dr. Walshe found seven only in which the anatomical character of phthisis was present. Primarily and principally, the two have different habitats. The womb, the breast, the stomach, and the liver furnish, according to the same careful author's calculations, about seven-eighths of the total sum of deaths caused by cancer; and these parts are never the primary seat of tubercle. Conversely, it is well known that in adults suffering under tubercular disease, the lungs are almost invariably affected, while those organs 'furnish but a contemptible fraction of examples of primary cancerous disease.'

Striking testimony to the same effect comes to us from beyond the Atlantic. Dr. Holden, of Newark, in New Jersey, after 23 years' experience in one of the largest American insurance offices, entirely 'dissents from any ideas of identity or similarity between the two affections.'

He gives the following strong statistical justification of his opinion.

Among 7,030 persons above 40 years of age—and more than half of them above 45—there were 99 cases of cancer.

Of the same 7,030, 1,032 had consumption in their own immediate families, i.e., in their parents, brothers, or sisters. Among these only eleven cases of cancer had ever occurred.

If the two sets were only equally liable to cancer, the odd 5,998 persons ought, according to the foregoing ratio, to have numbered among them nearly 64 instances of cancer. They actually numbered 88.

Again, 'of 55 deaths occurring in 821 families tainted with consumption, one only was occasioned by cancer, 33 by consumption. Still further, of 1,000 deaths from diseases of the bowels, and their appendages, there were 13 from cancer, and in but one of the families of these had consumption occurred, save one having both cancer and consumption.' I agree with his concluding sentence. 'Further comment would appear to be superfluous.'

Before I quit, for the present, this subject of cancer, I ought perhaps to mention another form of disease, which has by some pathologists been ranked in the category of carcinomatous affections, and called *colloid*, or gum cancer. It presents the appearance of small portions of a greenish yellow, transparent gum or jelly arranged in regular cells. Hence it is sometimes named *alveolar* cancer.

Whether this be in reality another variety of true cancer, or a disease *sui generis*, has long been, and still is, a *questio vexata*. It has been met with chiefly in the abdomen, affecting the intestinal canal, especially the pyloric end of the stomach and the peritoneum. It appears also occasionally in the bones, in the breast, and in the testicle. It spreads chiefly by contact and inoculation. Although sometimes combined with other varieties in the same person, it is oftener alone, and limited to a single organ. I believe it has not been met with except in adults.

For more minute information upon this whole subject, so interesting and important both in its pathological relations and in its practical bearings, I must refer you to Professor Walshe's very able and elaborate work on cancer; to a short but admirable essay on the same topic, by Dr. William Budd, published in the 'Lancet;' and to Mr. Paget's lectures. From these sources has been derived much of what I have now been stating.

Returning to our current theme, I proceed, in the next place, to speak, in a general manner, of the measures to be adopted when we are called upon to administer to the relief of a person labouring under inflammation; and thus we come, for the first time, fairly face to face with the proper and ultimate object of our special study and craft—the *treatment* of disease.

How are we to understand this familiar, and at first view almost presumptuous word? Do we propose to vamp and mend the animal machine when decayed, broken, or out of gear? According to the ordinary sense of those words, surely no. In urging upon medical students the indispensable necessity of anatomical knowledge, the question is sometimes put—What would be said of the discretion or sanity of him who, knowing nothing at all of its construction and working, should undertake to repair a damaged watch? However pertinent, in one light, the question may seem, it suggests a fallacious analogy. The mechanism which one man has devised and put together may be comprehended, imitated, and when out of order repaired, by another man of like intellect and skill. But the animal body is the handiwork of nature. Fashioned in obedience to unchanging laws imposed by the Creator, the processes of its formation can neither be clearly discerned by human intelligence, nor copied by human ingenuity. Through the natural laws thus ordained for its construction and maintenance, and not otherwise, can the imperfections, the hurts, the derangements, in one word the diseases of that complex machine, be rectified. One of the most wonderful and beneficent endowments of the body is, as I have said before, this, its self-mending power. The art of healing implies, indeed, some insight, however imperfect, into the operation of the forces by which the body is built up and sustained; but it requires a clear perception also that, through these forces, and through them only, may its flaws be sometimes remedied. The working of these forces, the results of these laws, we can, to a certain extent, control and regulate. By removing hindrances to their effective and salutary operation, by arranging the conditions which yield the best means for their success, by thus fostering, assisting, and directing the allotted powers of nature, we are able, not seldom, under Providence, to avert disaster, to mitigate suffering, to prolong life, to promote and conduct recovery, and in a certain limited sense to cure disease.

Keeping always in mind this limitation of our powers, let us now consider what is sometimes called the *cure*, but more correctly the *treatment*, of inflammation.

In describing the phenomena and progress of inflammation, I took *external* inflammation as a *type*, and I shall keep that type principally in view in what I have to say respecting its *treatment*: making, however, such reference to the inflammation of internal parts as the subject will permit. My design at present is merely to explain the *principles* of treatment, generally: I shall point out, by and by, the application of those principles, and the modifications they may require, in respect of particular cases. I speak also, now, of *common* inflammation, occurring in a person previously healthy. There are many observations that concern all inflammations alike, whether external or internal; and by despatching these in the outset, I hope to avoid much repetition hereafter.

In all cases of simple inflammation—by which I mean inflammation having a destructive and not a sanative tendency—our first object is, if possible, to obtain *resolution*: and if that be not possible, we next aim at securing *that event* of inflammation which would be the most fortunate in the particular case before us. In external inflammations *good suppuration* will generally, next to resolution, be the most desirable event: in internal inflammations it will be sometimes *suppuration*, sometimes *adhesion*.

It is necessary to keep in view the distinction between the treatment proper for the inflammation itself, and the treatment that may be required for the *effects* of the inflammation. At present we are concerned only with the inflammation itself.

I stated to you in a former lecture, that a knowledge of the *cause* of a disease might help us in its treatment. Knowing the cause, our first care must be to remove it, or put an end to it, if we can: and then the inflammation will in most cases get well, as the phrase goes, 'of itself.' In the case formerly supposed, we should extract from the inflamed arm the fragment of glass. If the inflammation have been excited by the extremity of a *fractured bone*, of a broken rib for example, we take measures for bringing the separated bones into their proper places, and for keeping them there: if the mere *displacement* of a part have occasioned the inflammation, as the dislocation of a joint, the protrusion of the bowel in hernia, the first thing to be attended to is the restoration of the part to its natural situation: if there be any *chemical* source of irritation (in the stomach, for instance, threatening or producing inflammation there), we eject, neutralise, or dilute it.

I know of but one exception to this rule, and it belongs to surgery: *to wit*, when a bullet or a splinter is so lodged in the interior of the body, that its extraction would be more hurtful or hazardous than its being left where it is.

A knowledge of the cause of an inflammatory disease may help us in another way. We do not treat a joint that is inflamed in consequence of external violence exactly as we should treat the same joint when inflamed in rheumatism.

But it is very seldom, except when the inflammation is external, that we can accomplish the removal of its cause. In most internal cases, either it cannot be got at, or it has already ceased to be applied; as when the inflammation has been excited by exposure to cold. Yet it may be possible, and it is of the utmost importance when possible, to prevent any *re*-application or repetition of the same cause, which would be likely to frustrate our endeavours to bring about resolution.

Next in importance to the removal and avoidance of the exciting cause, and prior to any use of direct remedies, must be placed, in most instances, the observance of what was formerly called the *antiphlogistic regimen*. The old epithet 'antiphlogistic,' derived etymologically from an obsolete theory, has gone indeed completely out of fashion; but the things intended by that brief phrase are of ever-during necessity and obligation. Let us call it the *pre-requisite* regimen. The phrase is simply a short and convenient form of expressing the sum of several distinct provisions for the welfare of the sick, and for the conduct of their attendants.

The object of the pre-requisite regimen is to remove all removeable hindrances of our patient's well-doing, to put and keep him in the state most conducive to the spontaneous subsidence of the disease, or most favourable for the sanative influence of remedies. This regimen consists in the avoidance of every adverse or disturbing influence that can be avoided, whether external or internal. Common sense will suggest to you the details. In grave cases of inflammation, the stomach loses its power of digesting meat, which then offends instead of nourishing. The regimen accordingly enjoins—what the very instinct of the patient usually prompts—a total abstinence from solid animal food, and mostly from strong drinks of all kinds. It prescribes the exclusion of all that might excite or exercise the mind, or produce a strong impression upon the senses: conversation provocative of thought; noise; bright light; great heat or cold. The patient should be kept in a temperature of about 62°, and in a well-ventilated room. He must not, I say, be allowed to converse, much less to attend to matters of business; except, indeed, his mind happens to be troubled and anxious about some point which one short interview with a friend may effectually settle. All causes of strong emotion, and mental agitation, should be strictly guarded against. Whatever tends to quicken the circulation is to be shunned; and therefore not only those influences which operate through the nervous system, but also all needless bodily effort and exertion, must be prohibited. The patient (in the serious cases I am now contemplating) must remain not only at rest but in bed: and in a position which facilitates, or at least does not impede, the free return of the blood by the veins from the suffering organ. If the inflammation be seated in or about the head, that part should be elevated by pillows. If one of the lower extremities be affected, even when the disease is not so intense as to require confinement to bed, the limb must be sustained horizontally, or be even still more raised up. On the same principle it is that we suspend an inflamed hand or forearm in a sling. In some cases of internal inflammation—in pleurisy for example—the patient will choose his own position. He is admonished, by the pain and discomfort they occasion, that certain postures would be hurtful or dangerous, and he carefully avoids them. We often derive much information and guidance from these instinctive cautions on the part of our patient.

The function of the inflamed organ should also be spared its exercise whenever, and in as great a degree as, that can be done. As you would not allow a patient to move an inflamed joint, so you must not permit him to gaze with an inflamed eye; to speak more than may be absolutely necessary with an inflamed lung, or larynx; to exert by thinking, and by attention to external excitements, an inflamed brain. This last rule is essential, even when the brain is not the seat of the inflammation: it is to be observed in all febrile disorders.

The adoption of this regimen is not, indeed, necessary, nor even proper, in all cases and stages of inflammation. The inflammation may be so slight as not to require it, particularly in external cases, of which the causes and the extent are known; as slight contusions, trifling wounds, and some kinds of eruption. But this exception must always be applied with great caution to cases of internal inflammation, about the causes, and extent, and tendencies of which we may be less sure. In chronic forms of inflammation, again, as in scrofulous inflammation of the lymphatic glands, or of the eyes, attended with but little pain or heat, some precepts of this regimen would often fail to be beneficial, might even be hurtful: the state of the general system being such as to require support and strengthening measures, more than the local symptoms require an opposite treatment. So also when suppuration or gangrene has supervened, some parts of the regimen must generally be modified, or abandoned.

But in the outset of all cases of serious inflammation, when the strength is entire, and the inflammation intense enough to produce pyrexia—and indeed in very many cases of active or perilous disease, whether inflammatory or not—all, or nearly all, the particulars of the pre-requisite regimen may require to be observed.

And such observance may sometimes be all, or nearly all, that *is* required. As the surgeon is often content to put together the edges of a cut or the broken ends of a bone, and trusts to nature (under which name we epitomise the vital restorative forces) for the rest, so the physician may be satisfied to facilitate the natural cure or recovery of his patient by simply adjusting his diet, and regulating his other surroundings. Indeed, it is better not to intermeddle further except for some plain purpose, dictated by reason or by experience. One thing greatly wanted in our science, in order especially to a right appreciation of remedies, is what is called a *Natural History of Diseases*; a knowledge of the time and the manner in which the natural forces, untrammelled by indiscreet interference, avail to bring about, in temporary illnesses, the desired return to the state of health; and, again, how these forces operate, for good or for evil (for they may sometimes work destructively), when the disease is inevitably mortal. But neither is this forbearance to be carried to a faulty extreme. What reason or tradition recommends is not to be omitted, to our patient's possible detriment, for the sake of obtaining an experimental contribution to our natural history of diseases. Besides those forces, or transmutations of force, by which the vital processes are governed —forces respecting which our notions are yet vague and indefinite—there are others which the body, its various parts, tissues, and structures obey—forces whereof the laws have been ascertained, so that we can express their relations in terms of number and space—the laws, to wit, of gravity, of chemical action, of hydraulic and pneumatic science; and these forces we *are* able, in some sort and degree, to bend and mould to our purpose by changing the conditions under which they operate; our guidance in doing so being founded partly on reasoning, but mainly upon accumulated experience. Returning from this digression, I may say that almost every grave case of inflammation demands the employment of remedies.

In the past records of the *direct remedies* of inflammation, the abstraction of blood from the body holds by far the most conspicuous place: and in the present day it is a measure that urgently demands, and will well repay, our most careful consideration and scrutiny. I hardly need say that there are several modes of abstracting the blood: venesection; arteriotomy; scarification; cupping (which is merely a variety of scarification); the application of leeches. These different ways fall obviously under two main and very distinct heads. In the one case, the blood is made to escape through a slit made in a considerable vessel, most commonly one of the larger veins, and the quantity of blood contained in the body is thus so far diminished: in the other, it issues from many capillaries and minuter bloodvessels, laid open by the bites of the worm, or by the blades of the scarificator, and its flow is promoted and accelerated by the suction power of the exhausted cup; and the quantity of blood in those capillaries and minuter vessels is thus diminished. We call the former of these methods *general* bleeding, or blood-letting; the latter *local* or *topical* bleeding. Considered as remedies, we shall find the two methods to be characterised by other differences of the highest practical importance. The failure to perceive this paramount distinction, first noticed in print, so far as I know, by Dr. Markham, has been the main cause of the strange and wide fluctuations of opinion respecting the true value of blood-letting that deform the annals of practical medicine. In times past, no doubt, bleeding, as a remedy, was apt to be employed inopportunely, to be misdirected, or to be pushed beyond its proper and safe limits; but of late, medical practice has rushed to the very opposite extreme. Which of the two mistakes is calculated to be most injurious to the human family it would not be easy to estimate. I remember the time when a surgeon who found a man lying in the street in a fit, was blamed and abused by the bystanders if he did not at once open a vein in his arm. To do this now-a-days would be to incur the charge of murdering the man. One melancholy consequence of blind submission to authority, or of the senseless influence of what is called fashion, is the almost total want of experience about blood-letting among the current generation of medical men. I have heard of a London physician who, being desirous of having one of his hospital patients bled, could find no one among the house surgeons and advanced pupils who had ever seen the small operation of venesection done, or knew how to do it; and of another who, wishing on some rare occasion to prescribe leeches, had forgotten, through long disuse of them, the Latin name of the little blood-suckers. The trade in leeches has dwindled to a miserable fraction of its former magnitude; and the art of cupping, and the once thriving and useful race of cuppers, are extinct.

It is argued by those who denounce blood-letting absolutely and altogether—and to whom some of our American brethren have applied the coarse but expressive nickname of *blood-funkers*—that every deviation from sound health implies a loss and lowering of vitality, and that the withdrawal of blood from the body has itself a depressing influence, and must therefore tend to aggravate, rather than to redress, the morbid condition against which it has erroneously been directed.

Now, there is abundant evidence that this great dread of abstracting blood is a mere bugbear. Men and women bear often large losses of blood with impunity; from wounds on the battle-field, in hundreds of accidents, in floodings from the uterus; and this not only during health, but also when the strength has been already reduced by disease. We see continually instances of profuse hæmorrhages, followed by no marked or abiding ill consequences, from the lungs in hæmoptysis, from the stomach in hematemesis; nay, even from the bowels in that exhausting disease, enteric fever. I have records of many cases of erysipelas, a disease of low type, which I saw treated years ago, in the infirmary in Edinburgh, by large and repeated bleedings from the arm, and which resulted in speedy and complete recovery. Mind, I am not commending this treatment, but founding my argument upon it. That blood-letting may be very dangerous and destructive scarcely needs a proof. Yet I give you two striking ones from Mr. Paget's lectures.

'One of Mr. Swan's donations to the College of Surgeons is the larynx of a man who, *while in low health*, cut his throat, and suffered so great a loss of blood that the nutrition became impossible in one of those parts to which blood is with most difficulty sent; and before he died his nose sloughed.'

'The case is like one which is recorded by Sir Benjamin Brodie. A medical man, *in a fit of exceeding drunkenness*, wished to be bled; and some one bled him—bled him to three pints. He became very ill, and the next day both his feet were mortified from the extremities of the toes to the instep.'

The reasoning, however, of the out-and-out decriers of bleeding is faulty and fallacious. 'Disease signifies always,' they say, 'a subtraction from the general welfare and vital powers of the body.' Granted. 'Your aim as physicians is to obviate this lowering.' This also, to a certain extent, we may admit. 'But the abstraction of blood *must* increase and promote it.' To this we demur. The relief of pain, in itself a great subduer of vitality—the removal of a local and lowering morbid process—the restraining of the circulation, throughout the frame, of blood altered and made poisonous by passing through the area of the part inflamed—the setting free or restoring the oppressed and hampered functions of a great blood-purifying organ, such as the lung or the kidney—these are very conceivable ways in which the removal of blood may operate in preventing, instead of furthering, the depression of vital energy. But, after all, the great argument for the abstraction of blood in inflammation is its conspicuous and undeniable *success* in innumerable cases; though the force of the argument may not be so apparent to those who have scarcely ever, if ever, seen the remedy put fairly to the test.

Prior to any experience, it might have been expected that the abstraction of blood would prove more or less remedial of inflammation. The inflamed part being overcharged with blood, and many of the phenomena of inflammation being direct consequences of that over-fulness, we might rationally look for advantage from a removal from the part itself of a portion of the superabundant fluid, and we recognise in fact such advantage. The results of experience confirm the suggestions of our reason. To this the practice of surgery bears daily witness. Apply leeches around a hurt ankle, or an inflamed eye, and you presently find that the pain, the swelling, the redness, abate; and the salvation, it may be, of the threatened joint, or of the organ of sight, in their former integrity and usefulness, is thus secured. Beneficial effects of this kind, produced by local blood-letting, you may see with your own eyes in any surgical ward: for the surgeons of this generation are wiser in this matter than their brethren, the physicians. Take an exquisite example. I cite it from a paper of Mr. Maunders', published in the fourth volume of the 'London Hospital Reports.'

A man, thirty-three years old, had sustained a lacerated wound above the patella, opening the knee joint. Acute inflammation had supervened; and it was deemed expedient to tie the superficial femoral artery.

'Immediately on the application of the ligature, pain, previously severe, ceased, and with this cessation sleep and appetite returned. On the following day, the countenance was changed from one expressive of physical suffering to that of repose, and the man pronounced himself to be "first-rate." Symptoms of inflammatory action, both general and local, quickly subsided, redness paled, swelling disappeared, and the integuments, previously rendered red, œdematous, and inelastic above, about, and below the knee, soon assumed their normal character.'

Surely this comes as near as may be to demonstration. The remedies are very few of which we can obtain proof so distinct, both of their remedial efficacy and of their *modus operandi*. Similar evidence is not wanting. Inflammation of joints has been unequivocally controlled and benefited by moderate compression of their main artery of supply. Facts like these justify the strongly-expressed views of the late Sir William Lawrence on this subject. 'If,' he says, 'we may be allowed to use figurative language, the obvious increase of heat in the part is analogous to that of fire; and blood is the fuel by which the flame is kept up: in fact, if we could completely take away its blood from the part, we should be able entirely to control or arrest the increased action.'

It cannot reasonably be doubted that the same happy results which are thus made evident to our senses when the part inflamed is external and visible, will follow a like withdrawal of blood from the inflamed parts which are internal and hidden from our view. It would be illogical to suppose any difference in this respect between an inflamed knee-joint and an inflamed kidney. But the difficult question immediately presents itself —can we by any means bring about, with safety to the patient, the wished-for limited abstraction of blood from parts that lie within the body? The knee-joint is close to the surface, which shares generally in its inflammation. Its capillaries, and those of the skin around it, have a common source for their supply of blood, are irrigated by the same arterial branches, are alike unloaded and eased by the suction of leeches. But this cannot be said of organs more internal and distant from the surface; yet experience testifies with no hesitating voiçe, to the relief given to a congested or inflamed kidney by cupping the loins, to inflamed bowels by leeching the belly. I trust firmly to the evidence of my own senses, and the conclusions of my own reason, in making this assertion. Dr. Markham endeavours to explain some of these instances of unquestionable success, by referring it to a reflex action of the nerves. He supposes that the irritation of the surface by the leeches or the cupping glasses may thus come to influence, through the vaso-motor nerves, the vessels of the internal part, and cause, perhaps, their contraction, and so tend to reduce the supply of blood through them to the part. So far as the mere loss of blood goes, he sees no difference, in cases of deep-seated inflammation, between local and general bleeding; and remarks that the blood might just as well be taken from the thigh or the back of the neck as from the surface nearest to the inflamed part. For myself, I have always thought and taught that in such cases 'topical blood-letting produces its effect by diverting the flow of blood from the affected part, and giving it a new direction, and so indirectly relieving the inflammatory congestion.' But Dr. George Johnson, in one of his published lectures, has much more fully and clearly given, what I do not doubt is the true explanation. He points out the sufficiency of there being a close *arterial* link of connection, although there may be no direct community of *capillary* vessels, between the part inflamed, and the place where the local bleeding is effected. The stream of blood passing through a branch or branches which enter and feed exclusively the suffering part, will be lessened in proportion to the amount that is withdrawn from contiguous branches of the same artery.

This position Dr. Johnson illustrates by comparisons so familiar, and so happily chosen, that I shall read them to you. He had been considering the case of pericarditis:—'The internal mammary artery supplies the pericardium and the integuments over the heart. By the application of leeches over the heart, we abstract blood from the integumentary branches of the internal mammary artery, and in the same proportion we divert blood from the deeper pericardial branches.' So, 'when my opposite neighbour, Mr. Poole, exhibits his well-known illumination, he so depletes the main gas artery of the street, that the chandelier in my dining-room burns with a faint and feeble light. Mr. Poole obviously takes no gas directly from my pipes—there is no immediate "capillary communication" between my pipes and his—yet, by his rapid consumption, he diverts the gas from my burners. My chandelier, therefore, is the analogue of the inflamed pericardium, when leeches are drawing blood through the skin. This is literally a case of inflammation being mitigated by local depletion.'

'I was giving this illustration to an intelligent non-medical friend, and he said, "I can give you another instance. I have a long pipe from a cistern for watering my garden; at the end of the pipe there is a tap for watering the ferns; nearer the cistern there is another tap for supplying the general surface of the garden. Sometimes, when I am watering the ferns, I find a sudden diminution of the stream, and I know that my sister has turned on the other tap for watering the garden." Here, again, the ferns are in the position of the inflamed pericardium.'

'I am indebted to another friend for the following illustration. A spring on a neighbouring height supplies a house with water; and on its way there a branch pipe goes off to a fountain in the garden. When water is being drawn off through a large tap in the kitchen, the fountain jet is much reduced in height. Here again the fountain represents the inflamed pericardium.'

I hold it, then, to be certain, that in many cases of inflammation, *local bleeding* is a powerful, a safe, and therefore a proper and eligible remedy: and that its beneficial operation consists in diminishing, by direct withdrawal, or by diversion, the quantity of blood distributed to the part or organ inflamed.

But what of *general bleeding*—what of venesection in particular—as a remedy for inflammation? It is in this matter, I am bound to admit, that great mistakes have formerly been made; that a potent agency has been misdirected. By abating the force of the heart's contractions, by diminishing the quantity of blood circulating throughout the body, venesection may, no doubt, lessen the quantity dispensed to the area of inflammation. But to do this to any effectual purpose, the amount of blood thus abstracted must be so large as to affect injuriously for a time, or even permanently, the whole of the frame—to impoverish the blood, to weaken the reparative powers of the body, and to compromise both the present and the future well-being of the patient. These drawbacks to the value of venesection have never been overlooked, but its local influence upon the part inflamed has been overrated. If indeed there should be great excitement of the circulation, a single, early, and moderate bleeding from the arm of a previously strong and healthy patient may calm the general fever, and so facilitate the cure of the inflammation; but there are other means of repressing this tumult, and the main object of the abstraction of blood, namely, the easement of the gorged and overladen vessels of the part, ought almost never, in my present judgment, to be attempted by venesection. That is the direct and proper object of topical bleeding, which has this further advantage over general, that the blood removed by it is especially blood altered, and made pernicious probably, by its intimate participation in the local inflammatory process. *Almost* never, I have said, because there is at least one exception to such a rule. There are conditions in pneumonia—the very disease that has been the battle-field for the recent contentions about blood-letting—there are in that special disease conditions which warrant and require venesection, not indeed as a form of *general* bleeding, but as a derivative *topical* bleeding of the very part inflamed. It is peculiar to the lungs that all the blood of the body has to pass through them; and under their inflammation, the portions of those organs that remain permeable by blood may be totally unequal to transmit the requisite quantity; and death may be the imminent consequence of that inadequacy. In this stress, venesection may sometimes suffice, when all other means would fail, to avert the fatal issue. To tap a large vein, to draw off a portion of the circulating blood on its way back towards the lungs, must tend indirectly to diminish the pulmonary engorgement, to divert blood from the imperilled organ. What the conditions in question are, I shall enquire at a future time, when I shall also have to show you how often the same disease, pneumonia, may be brought to a happy termination without any need of bleeding, whether general or topical.

Is this, then, it may naturally be asked, the explanation, and the sole explanation, of those cases which we read of in books, which all who have had much experience of blood-letting are practically familiar with, of 'inexpressible relief,' of rescue even from impending dissolution—obtained at once by opening a large vein—the good result being so marked and so immediate as to compel our acknowledgment of its cause? Cases, I mean, of emergence from coma, of the subsidence of urgent dyspnœa, of the departure of unspeakable pain and anguish, while the blood is still flowing? No. The condition that I have just been speaking of as incidental to some cases of pneumonia is but one of several morbid states, for which prompt and free venesection is the appropriate, and the only adequate, remedy. All these morbid states are now recognised as belonging to one and the same category. The striking relief is always due to liberation from the effects of a mechanical obstacle or block in the circulation. Dr. Hughes Bennett, a strenuous denouncer of blood-letting except in these emergencies, Dr. Markham, and Dr. George Johnson, who advocate its limited and rational use, all agree in this. As the source of the danger and difficulty, Dr. Bennett assigns, 'over-distension of the right side of the heart, and perhaps venous congestion and engorgement of the lungs.' Dr. Markham, 'some mechanical obstruction to the play of the thoracic organs, and a consequently distended, oppressed, and partially paralysed heart.' Dr. Johnson, 'over-distension of the venous system, including, under that term, all the vessels that contain black blood.'

You will observe that this *accident* of disease—for such it is—may or may not be associated with inflammation; and it is to the accident, and not to the mere inflammation, when that is present, that the remedy is addressed and adapted. Dr. Reid long ago showed, by experiments, how a distended and motionless right ventricle—motionless in consequence of its distension—may be set going again by opening the jugular vein of a dying animal, and suffering the blood to flow back, as it will do, from the gorged right cavities of the heart. One instructive example of the same thing in the human subject I quote from Dr. Johnson's lecture. A woman was brought into the hospital labouring under chronic renal disease, and considerable anasarca, with the physical signs of engorgement of the lungs, and of liquid in the left pleura. She was gasping for breath, in great agony; the face was blue; the eyeballs were prominent and watery; the jugulars much distended. She was apparently dying from over-distension of the right side of the heart. The jugular vein was opened. About ten ounces of blood escaped. As the blood flowed, the distension of the veins was seen to subside; the breathing became easier before the blood had ceased to flow; in ten minutes the dyspnœa had passed away, and it did not return. She died three weeks afterwards, gradually worn out by the results of advanced renal degeneration.

Whenever, in cases of this kind, you decide upon opening the external jugular vein, take care to prevent, by due pressure or otherwise, the entrance of *air* into the vein; an accident which has sometimes happened, and which is not less perilous in its consequences, while it is much less within the reach of aid, than the dangerous condition that you are seeking to redress.

I hold it, then, to be certain, that for some special morbid conditions, which inflammation may or may not accompany, general blood-letting, and especially venesection, is a potent and life-preserving remedy; that there are many exigencies for which it is not only safe to employ, but unsafe and unpardonable to withhold it. I shall have to return to this subject hereafter, but I may repeat now in brief terms that the condition which cries out for and obtains relief so signal and immediate from phlebotomy, may be described as that of great, and often sudden, engorgement and distension of the vessels that (I use Dr. Johnson's phrase) carry black blood—of the systemic veins, of the pulmonary artery, and especially of the right chambers of the heart. In this embarrassed condition of the circulation, with so unequal a distribution of blood in the two different systems of vessels, it is the veins that require emptying, not the arteries. As the tension of the stretched and almost paralysed right ventricle is lessened, the hollow muscle again becomes capable of contracting upon and propelling its contents, the clogged lung is set free, the functions of the oppressed brain are eased and retrieved, and the balanced play of the heart and lungs is restored.

This, as it seems to me, is the true philosophy of blood-letting in disease, approved by reason, and fortified by experience. The credit of having been among the first to rectify the vaguer notions that formerly prevailed on the subject is fairly due to Dr. Markham.

There are yet some minor points that deserve a short notice:—

First, as to the relative advantages and eligibility of cupping, and of the application of leeches, as topical remedies for inflammation. It may be said in favour of cupping, that the exact quantity of blood taken away is more accurately determinable in that manner; and the operation is sooner over, and is less fatiguing, than the suction of leeches. The risk of erysipelas, which sometimes ensues upon leech-bites, is also avoided. On the other hand, the leeches seldom bungle in their work, while the surgeon sometimes does. It requires a good deal of practice to become handy and dexterous in the use of the glasses, to avoid torturing and burning the patient; and therefore it was that in large towns, as in this metropolis, cupping was formerly cultivated as an *art*, and practised by a distinct class of experts. But the art and the special skill, are, as I said before, at present unfortunately in abeyance. Again, leeches may be applied to parts of the body where the cupping-glass could not well be planted.

You are not to suppose—even if you are convinced, as I am, of the great value of topical bleeding—that it is a suitable remedy for every case of inflammation. The nature and importance of the part affected will influence our judgment in that matter. If the organ inflamed be a vital organ, we need not hesitate to take away blood. But when the part is of less importance in the economy of the body, or when the inflammation is known ordinarily to run its course without producing any abiding damage—as happens, for example, in most cases of tonsillitis, and of acute rheumatism without cardiac complication—it will generally be advisable to abstain from bleeding, which might do more harm than good.

Always it is necessary to consider the age, the sex, the general temperament and condition of the sick person, when we are turning over in our minds the expediency of abstracting blood. The very young, the old, the feeble, the cachectic, do not bear well the loss of much blood. This consideration is not to deter you from bleeding such persons topically when they are attacked by dangerous inflammation, but it especially enforces, in regard to them, the golden rule that no more blood should be abstracted than seems absolutely requisite to control the disease. When inflammation supervenes on other chronic disease; whenever it arises in the progress of specific fevers, or whilst the blood is contaminated by some special poison; whenever suppuration is inevitable, or even probable; in all these cases we cup or leech our patients reluctantly and guardedly, and only in obedience to pressing and unequivocal indications.

In all cases of acute inflammation, when bleeding is contemplated, the period or stage of the disease forms a most important element, the most important indeed of all, in our determination. It is of inflammation while yet in its earliest progress, if ever, that the abstraction of blood from the part may be emphatically pronounced the cure; while the disease is still within the possibility of resolution; before there is any great amount of exudation, or any serious disorganisation of structure. The sooner we deplete the part, the more surely will the inflammatory process be moderated and limited, even when it cannot be wholly quenched. In no case within the range of medical practice is the maxim 'principiis obsta' more imperative. While the removal of blood may be called the *summum remedium* for active inflammation at its very commencement, there is a point beyond which it not only does no good, but may be positively injurious. Bleeding may arrest inflammation, but it will not remove the effects of inflammation; nay, by diminishing the supply of healthy blood essential to their removal, it may render them lingering in their departure, or even augment their tendency to be fatal. I cannot too often or too strongly inculcate the precept that, in order to extinguish or check acute inflammation, you must, above all, bleed *early*.

Hitherto I have been speaking of active or acute inflammation. But topical bleeding is scarcely less valuable as a remedial measure in many cases of *chronic* inflammation; when the system at large scarcely sympathises at all with the local disease. As in acute inflammation, you should bleed early, so in chronic you commonly have to bleed *often*. But in these cases you must bleed sparingly also. The remedy must be used chronically when the malady is chronic—and much more blood may thus be taken for the cure of a chronic inflammation, than of one that is violent and acute; but then the bleeding is spread over a larger space of time.

Much has been said heretofore, by others and by myself, about the hardness of the arterial pulse, as a lawful warrant in many cases for the abstraction of blood. The hardness is ascertained, and the degree of it measured, by the resistance which the throb of the artery makes to the pressure of your finger. The pulse is sometimes said to be incompressible; which means that although you apply your finger with considerable firmness, the blood still forces its way through the vessel beneath it. Modern views, however, of the mechanism of the circulation, healthy and disordered, have deprived this indication of much of its value. In that special condition for which free venesection is the most fitting and successful remedy, the pulse is small and feeble, and regains fulness and strength in proportion as the block to the circulation is removed, and the contractions of the right ventricle of the heart resume their force and efficiency. When this change takes place in the pulse under the abstraction of blood, we may be sure that our practice is right. It is overfulness of the veins, and not strength or hardness of the arterial pulse, that is the true indication for venesection. Venesection and the administration of stimulants are by no means necessarily incompatible or conflicting remedies; and a liberal supply of nutritious food—limited only by the patient's power to digest it easily—is almost always not only permissible but expedient. Moreover, in reference to topical bleeding, the pulse may be habitually hard when there is no inflammation. Certain chronic diseased conditions of the heart may occasion the hardness. It belongs also, as I shall explain to you hereafter, to certain morbid conditions of the kidney; and it probably results, sometimes, from some unnatural state, other than inflammation, of the whole of the circulating or of the nervous system. Apart from these peculiarities, I agree with Mr. Simon in thinking that 'any inflammation accompanied by hardness of pulse is likely to be relieved by the abstraction of so much blood (locally) as shall remove this sign of vascular tension,' especially when 'the inflammation affects important organs.'

The *evacuation* next in importance to blood-letting, is *purging*. This is an expedient which in cases of violent inflammation, or high general fever, should seldom be omitted. To keep the bowels what is called *open*, forms indeed a part of the requisite antifebrile *regimen*; but in many acute inflammatory diseases, active purging is often of very great service. It is both depleting and derivative. These two points are gained by it. The stomach and intestines are freed from accumulated fæces, or other matters which, by their bulk or their acrimony, might prove irritating: and at the same time depletion is carried on by means of the serous discharge which is produced from that large extent of mucous membrane. There are some cases of inflammation in which the operation of purgative medicines is of especial benefit; as in inflammatory affections of the head, either external or internal, of which part these medicines assist or cause the depletion in a very sensible manner. We have an illustration of this in the paleness of the face, which often, during health, accompanies the action of a brisk cathartic. The usefulness of repeated purgatives is less distinctly seen in inflammations situated within the thorax; although in these cases also they are often very beneficial. They are efficient remedies too in all inflammatory conditions of the liver. But when inflammation has fastened upon the stomach or bowels themselves, although it may be generally desirable that they should be unloaded of their contents, which are often composed of irritating ill-digested food, and of morbid secretions no less teasing and hurtful, the propriety of going beyond this point is extremely questionable, and sometimes purgatives are altogether inadmissible. I believe that much harm has often been done by pressing the inflamed alimentary canal with active purgatives. But to all these points I shall have occasion to return.

At first sight there would seem to be much of promise in the agency of external *cold*, as repressive of inflammation; and it *is* of great value. Yet, when looked into more closely, its beneficial use appears to be confined within somewhat narrow limits. Applied early and continuously, it allays the burning pain, moderates the heat, and hinders the extension of *common* inflammation, occurring in or close beneath the skin. Probably there is scarcely anyone among you who has not experienced the relief given from the *pain* of a burned finger, by dipping it in cold water; and the return of the pain upon taking the finger out again. The cold may be applied so constantly and long, that the pain will at length cease to recur when the application is suspended. Dr. John Thomson relates a case in which a burned arm was kept immersed in cold water for two days and two nights incessantly; and inflammation was thereby wholly prevented. I have known this expedient fail however—fail at least of a result so perfect. A nurse in the Middlesex Hospital fell as she was carrying a pail of hot water upstairs, and in her fall thrust one of her arms into the scalding liquid. Without loss of time she plunged the same arm into cold water; but after a while she was obliged to desist, the cold immersion bringing on severe rigors. The cold acts by contracting the cutaneous and subcutaneous arteries, and checking the afflux of blood towards the part inflamed. In surgical practice, the mischief of a recent hurt is controlled and circumscribed by the immediate and constant application of linen or lint made and kept wet with cold water of uniform temperature. But if the inflammation has been the outcrop of some blood-poison, great risk will arise that, repelled by the cold, it may be translated to some other place where it might be far more perilous. This is no mere figment of the fancy, but a real danger. The gouty poison, seeking vent from the blood into the joint of the great toe, has been driven thence, by the rash immersion of the foot in cold water, to settle with fatal issue upon some deeper and more vital part. Similar evils are apt to follow the repulsion of cutaneous eruptions, which indeed are specific inflammations.

External cold has been employed too, more in Germany, however, than in this country, in the treatment of acute *internal* inflammation, inflammation of the viscera or of their investing serous membrane; but for this purpose also it is but an ambiguous remedy. To an inflamed membrane very near the surface, the cold may be said to be applied almost directly, and may perhaps be useful. Its influence upon viscera at a distance from the surface is supposed to vary in different cases. It may either do harm by chasing the blood from the superficial blood-vessels, and so leading to its greater accumulation and congestion in those of the distant organ; or it may do good by constringing the distant arteries through some intermediate reflex or sympathetic operation of the nerves. In illustration of this latter property, authors adduce the popular remedy for nose-bleeding in children—the slipping a cold key between the clothes and the skin of the shoulders, and so causing a sympathetic shrinking of the bleeding vessels. What is called *goose-skin*—the creeping roughness of the general surface which comes on when one wades into very cold water, and which is produced by the contraction of the skin round the glands of the hair-roots—is another example of this kind of sympathy. Now as I know of no means of insuring one rather than the other of these distant effects of external cold, and cannot even foresee which of them, if either, is the more likely to happen, I call the proposed remedy ambiguous. And Nature being in one side of the balance, and the Doctor in the other, I should in this case reverse, if the alternative were inevitable, the maxim of Celsus, and say, 'Satius nullum auxilium quam anceps.' But the alternative is not inevitable. Other and opposite appliances remain, and are to be preferred: *warmth* to the surface, moist warmth by means of poultices and fomentations, dry by means of flannels and cotton wool. The warmth, besides its soothing effect upon the patient, 'relaxes the subcutaneous arteries; the skin therefore receives a larger supply of blood, and in the same degree blood is diverted from the part inflamed. There is also a sort of depletion from the full cutaneous capillaries by the free local sweating which the warmth occasions.' These, therefore, in my judgment, are safer, more surely sanative, and pleasanter than cold applications in inflammations of parts within the body, and even of some inflammations upon its surface. In erysipelas, for instance, I am certain, from my own experience, that warm fomentations not only afford more comfort, but are more effectual and safer than cold lotions. And you may take it as a general rule that the instincts of the patient—or rather his feelings and preferences—may be trusted to in this matter. Whatever gives comfort, is likely to do good; whatever causes discomfort, is likely to do harm.

Independently of their influence in promoting *resolution*, warm applications—warm soft poultices for instance—are often used with the view of forwarding *suppuration*. Hence this rule. Whenever resolution may *possibly*, but suppuration is *likely to* ensue, warm applications are the most proper: because under their use we have an equal chance of obtaining resolution, with less hazard of retarding or rendering untoward the process of suppuration, in case resolution does not take place.

Counter-irritation, by means of blisters, sinapisms, embrocations, irritating ointments, setons, issues, or moxas—what is to be said of this as a remedy in inflammation?

I disapprove entirely of all strongly irritant applications to the skin, in the early stages at least, of acute internal inflammation. They add a new grief to the old, and augment the existing febrile commotion. In many chronic inflammations, however, and in the recession and decline of those that have been acute, blisters, which are at once derivative and depletory, are often of great service. As cold, when useful at all, is especially so in the outset of inflammation, blistering, when useful at all, is especially so towards its close. Upon these points I shall have to speak more in detail hereafter.

Dry cupping—cupping without scarification—is an expedient by which a temporary diversion from the suffering part without any actual loss of blood, is sometimes attempted. Nice handling and great care are, however, required to effect this cleverly. Very often the blood is dragged out of the capillaries into the surrounding tissues, and is as truly 'lost' as if it had left the body at once. Ecchymoses remain to be more slowly removed by absorption. It is, for this reason, an expedient which I do not much like, and rarely prescribe.

There are three or four *drugs* of repute and power, about which I must say something before I quit my present subject.

Bear in mind that it is only as remedies for inflammation or its effects that I now notice them at all. *Mercury* is the principal of these; and of the virtue of mercury in the treatment of inflammation I may say, as I said of the virtue of blood-letting, that within the last few years great changes have taken place in medical opinion. Its effects have been more accurately ascertained; its uses more clearly defined and apportioned. Formerly it was regarded as 'a very powerful agent (I am quoting myself) in controlling inflammation; especially acute, phlegmonous, adhesive inflammation; such as glues parts together, and spoils the texture of organs.' Again, 'the great remedial property of mercury is that of stopping, controlling, or altogether preventing the exudation of coagulable lymph; of bridling adhesive inflammation; and (I added) if we in our turn could always bridle or limit the influence of mercury itself, it would be a still more valuable resource.' Acknowledging that, like most other remedies, it could do harm, as it could do good, I said it behoved us 'to learn how to wield a very potent but a two-edged weapon.'

This estimate of the special properties of mercury can no longer be maintained in the full and unqualified sense of the words which I have just cited, and which expressed, I believe, at the time when they were used, the general opinion of the profession. They were too absolute. The error arose from too hasty generalisation. With certain exceptions—large exceptions I must admit—the statement is still strictly true.

When mercury is gradually introduced into the human body in small quantities, it produces sooner or later very remarkable effects. It *causes* inflammation. Perhaps it may be for that reason that the professors of homœopathy prescribe 'mercurius' so often. The gums grow redder, become tender, swollen, and spongy, and finally they ulcerate. The teeth are less firmly fixed. The patient complains that his gums are sore, that he has a metallic taste, a taste like that of copper, in his mouth, with an unusual abundance of saliva. He is accordingly said to be salivated. At the same time an unpleasant and very peculiar fœtor, easily recognised again when it has once been perceived, is smelt in his breath. If the drug be still further pushed, the submaxillary glands, and the tongue, swell; a prodigious quantity of saliva is apt to be discharged; and in extreme cases the inflamed parts may perish; the cheeks sometimes slough internally; and not the gums and cheeks only, but the throat and fauces, grow red, and sore, and sloughy.

As soon as the gums *begin* to feel tender, and the peculiar fœtor manifests itself, we know that the patient is fairly under the specific influence of the remedy—in medical language, is *mercurialized.*

I must take you, for a moment, out of the domain of *general* pathology, with which alone, hitherto, we have been concerned, and set before you a single case of *special* pathology, in elucidation of the subject under our consideration. I am going to describe to you one of the diseases of the *eye*; a little organ, but the theatre in which many forms of disease present themselves, and play their parts in miniature as it were, and disclose to our view changed and changing conditions, such as we can in no other case of internal disease study with so much certainty and advantage. I am going to describe inflammation of the *iris.*

The little cavity across which the iris is vertically stretched, is lined by a smooth membrane, the source of the watery fluid always contained in the cavity. This membrane is analogous in its smoothness, in its forming a shut sac, and in the nature of its secretion, to the serous membranes met with in other parts of the body: it is analogous also to the serous membranes, in its behaviour under inflammation. It *is*, in fact, the serous membrane of the eye. Now we have the means of inspecting a portion at least of several of the *mucous* surfaces of the body: but this serous cavity, constituting the anterior chambers of the eye, is the only *serous* cavity into which we have the privilege of looking as through a glass, and of noting what is going on, when the membrane that forms its boundary is inflamed; and this it is that makes iritis, to me, one of the most interesting of diseases. I treat of it the more willingly because it is the only malady affecting the eye that I intend to include within this course of lectures.

All the changes which occur in iritis depend upon the circumstance that the inflammation, like that of the serous membranes generally, is of the adhesive kind; i. e., is attended with the effusion of coagulable lymph. By means of this lymph the form and the colour of the part are changed; the size and figure of the pupil undergo alterations, or that aperture is completely closed up; the motions of the iris are limited, or entirely put an end to.

The symptoms which characterise inflammation of the iris are very obvious. To be perceived and understood, they require only to be looked at.

I will first enumerate them, and then speak of each rather more particularly. Redness of the sclerotica; a change in the colour of the iris itself, and in its general appearance; irregularity of the pupil, produced by adhesion of the iris to the neighbouring parts; immobility sometimes of the pupil from such adhesion; a visible deposit of coagulable lymph. All these changes are apparent and conspicuous. Scientific writers term them *objective* symptoms. Then there are also the *subjective* symptoms, of which the patient alone is conscious—impaired sight; pain in the eye, and around it.

The *redness*—or in this case the pinkness—results from undue fulness of vessels that traverse the sclerotic. The cornea is surrounded by a zone of fine straight converging pink lines, very different in appearance from the larger, tortuous, anastomosing, scarlet blood vessels of the inflamed conjunctiva. These hair-like converging lines stop abruptly at the edge, or just before they reach the edge, of the cornea; they dip through the sclerotic, in fact, to go to the iris. The vascular zone therefore is well defined in front, while it becomes fainter from before backwards, and is gradually shaded off, the posterior portion of the sclerotic being generally pale. As the disease advances, and in violent cases, the more superficial conjunctival vessels also sometimes enlarge, and mingle their tint of redness with that of the sclerotic, and more or less confuse or conceal it. Now this red zone or halo continues as long as the inflammation of the iris continues, and disappears when that ceases. It is an important symptom therefore.

The change in the *colour of the iris* itself is also a notable circumstance. You know that what is called the colour of the *eye* is simply the colour of the *iris*. When lymph begins to be effused into the texture of this coloured part, it deepens, and at the same time alters, its tints. A gray or blue eye is thus rendered yellowish or greenish. A dark eye presents a reddish tinge. The change is such as would be produced by a mixture of the colour of the lymph with that which is natural to the iris. But besides a variation of colour, the peculiar brilliancy of the surface is spoiled. It becomes dull and tarnished as it were, and the fibrous arrangement, which is usually so evident, is confused, or lost. The change commences at the inner or pupillary margin of the iris, and extends gradually towards the outer or ciliary edge. This is a symptom which you can scarcely overlook. It is rendered certain and unequivocal by comparing the sound eye with that which is inflamed.

The change of colour which I have been describing is occasioned by the *effusion of lymph.* But the same event of inflammation leads to various other changes, not less striking, and more important, in so far as the functions of the organ are concerned. The lymph becomes visible upon the surface of the iris. Its precise appearance varies considerably in different cases. Sometimes it presents little spots like freckles, or specks of rust: or a thin stratum of the same colour is visible. Sometimes it exhibits the appearance of drops, or (as they have been improperly called) tubercles, embossing the surface, and projecting from its pupillary edge. These are commonly of a yellowish or reddish brown colour, and they vary in magnitude from the size of a small pin's head, to that of a large shot. There are seldom more than two or three of these masses. The lymph thus effused upon, or thrusting forward the surface, is confined almost always to that part of the iris which is nearest to the pupil, to the annulus minor; while its ciliary portion, or annulus major, is dull and clouded; its free edge, which in the natural state is clear and sharp, becomes rounded and blunt: and at the same time the pupil often begins to lose its jet-black colour.

Another very common consequence of the effusion of lymph from and upon the surface of the iris (from its hinder surface, that is, which is called the uvea, or from its pupillary edge), is its adhesion to the capsule of the crystalline lens, which lies, you know, behind the iris and very near it. And the pupil itself is apt to become blocked up by lymph.

The motions of the iris are seriously impeded by the mere effusion of lymph into its texture. At first it moves sluggishly under variations of the light; gradually the pupil contracts, and becomes fixed and motionless. The adhesion of the iris to the capsule of the lens still more decidedly restrains the action of the part. When it adheres at one or more points of the margin, and remains free elsewhere, the pupil is deformed; loses its circular shape; becomes angular; and this deformity is the most marked when the eye is examined either under a weak light, which allows the pupil to dilate, except at the points where the iris is tied down to the lens; or under a very strong light, which forces the free portions of the margin, and those only, to approach the centre. Still more palpable does the alteration of figure become when the pupil is artificially dilated.

Vision is always impaired in this complaint; partly because the posterior tunics of the eye are liable to be implicated in the inflammatory process; partly by the detriment done to the proper function of the iris, which should duly measure and moderate the quantity of light admitted to the retina; partly by the presence of more or less lymph, filling up the pupil; and partly by a change, not yet mentioned, which is apt to take place, especially in severe cases, in the cornea, and perhaps in the aqueous humour. The cornea becomes hazy and dull, and loses its bright polish. It looks like a piece of glass that has just been breathed upon. It has been thought (on the ground of analogy chiefly) that the aqueous humour grows turbid under the inflammation of the membrane that secretes it: just as serous effusion into the pleura is often found to be troubled and thick. But there is no sure evidence that this is the case. While the cornea remains transparent, the aqueous humour is seen to be clear: when the cornea is dim and semi-opaque, we cannot distinguish the state of the aqueous humour.

Acute iritis is attended with pain and intolerance of light. To the latter circumstance is probably owing the contraction of the pupil during the progress of the inflammation: and then the lymph *fixes* the pupil in that state of smallness and contraction. There is pain in the eyeball itself, and in the parts about the eye, the brow and temple, most severe at night. There is much variety, however, in regard to the pain. Sometimes it is constant and severe, but still more aggravated in nocturnal paroxysms. Sometimes, even when the quantity of mischief that is visible is very great, scarcely any pain at all is experienced.

The same remark applies to the constitutional symptoms. In some instances these are but slightly pronounced; but in most cases, particularly in acute cases, there is a good deal of fever and headache, the pulse is full and hard, and the tongue white, and the sleep is broken.

These are the phenomena which mark the onset of the most common form of iritis, as it occurs in adult persons. I do not propose to follow the progress of the disease further. The weapons wherewith we combat it are three: *blood-letting, mercury, belladonna.* I restrict myself to the consideration of the first two, and chiefly to the second.

Blood-letting—topical, by means of leeches or cupping glasses—may be of great service, but it will not cure the disease; or it will not cure one case in a hundred. It may *stop the inflammation* probably, but not till the organ has been spoiled. Such a termination cannot with any propriety be called a cure. We want not only to put an end to the inflammatory process, but to repair the mischief which may have been already done. In this disease, at least in one species of it, mercury is our sheet-anchor; and we give it till its specific influence is obtained; and it may be obtained, usually, by giving some form of mercury in equal and repeated doses, by the mouth. For urgent cases calomel is the best form in which it can be administered: two or three grains given every four or six hours, equal doses at equal intervals, will generally suffice to touch the gums in the course of thirty-six or forty-eight hours. If it act as a purgative, its specific effect upon the whole system will be postponed by that circumstance; and it then becomes expedient to combine with it just so much opium as will prevent its passing off by the bowels. A quarter of a grain of opium with two grains of calomel—or a third of a grain of opium with three or four grains of calomel—will generally be sufficient to restrain the purgative operation of the latter. Remember that profuse salivation is neither needful nor desirable.

Whatever else you may have done in the way of treatment, you perceive, on looking from day to day, or from hour to hour, into your patient's eye, that the mischief is still going on, and the deposit of lymph increasing. But the instant that his gums and breath acknowledge the specific agency of mercury upon his system, a welcome change becomes apparent: the red zone surrounding the cornea begins to fade; the drops of lymph to lessen; the iris to resume its proper tint; and the puckered and irregular pupil once more to approach to the perfect circle; till, at length, the eye is restored to its original integrity, and beauty, and usefulness. The disease is cured.

And does this splendid and wonderful success always wait upon the timely administration of mercury when the iris suffers inflammation? Alas! you will have gathered from what has already been said, that I am compelled to answer 'no.' Mercury is infallible, or all but infallible, in that particular form or species of iritis which is produced by the presence in the system of the hateful virus of syphilis. It is one among the early secondary symptoms of that disorder, sometimes the very first. Syphilitic iritis is also by much the most common form of iritis. But the iris may undergo inflammation from other causes; from mechanical injury for instance, from blows, and even from surgical operations performed upon the eye. When thus excited by mechanical violence it is usually acute. A chronic form of the disease is sometimes brought on by over much use of the organ of vision; in women who occupy themselves with fine needle-work, perhaps by candle-light; in engravers, and other persons who are in the habit of looking at minute objects, or at bright objects. No doubt the retina is more often affected by this strain, but sometimes (however the fact may be explained) it is the iris that suffers. Again, iritis is frequently met with in association with rheumatic disease, which manifests itself at the same time in other parts of the body. In respect of all these other forms of iritis, they who are most conversant with ophthalmic disease do not find mercury so eminently curative; it may even be harmful. The late Sir William Laurence indeed has recorded his opinion that 'its influence is not confined to the syphilitic form of the disease, but extends equally to the idiopathic.' The result of more recent experience is, however, opposed to that belief. Other and various remedies are combined with a more restricted use of mercury, or supersede its use altogether. It is in syphilitic iritis only that we may confidently offer to our patient Benvolio's advice to the slighted Romeo—

> Take thou some new infection to thine eye,
> And the rank poison of the old will die.

The hope so earnestly cherished, that the specific influence of mercury, if early induced, might prove equally beneficial in common inflammation of other serous membranes, of the pleura, the pericardium, the peritoneum, the arachnoid membrane—this natural hope has been disappointed. I do not tell you that mercury, short of salivation, is always misapplied in the treatment of those other inflammations; but it cannot be relied upon for their cure, for preventing the effusion of coagulable lymph, and its consequences.

It is surely a singular and most suggestive fact, that one poison should thus serve to expel another. We have a further example of the same thing in the rapid removal of syphilitic nodes, in their early stage, by the iodide of potassium. Probably this last circumstance has led to a too sanguine expectation that the iodide may have a similar power to produce absorption in other morbid conditions of the body. The same remark may, indeed, be made respecting mercury. When you look, I repeat, from time to time into the aqueous chamber of an eye in which syphilitic iritis has recently produced its peculiar changes, and after the due effect of mercury upon the gums has been achieved, you will be surprised as well as delighted to see large masses of lymph rapidly disappear, melt away, as it were, from the surface of the iris, while that which had been deposited in its intimate texture, rendering it confused and discoloured, as quickly clears off. And this spectacle may incline you to believe, as many have done, that mercury has a vast influence in promoting and accelerating absorption. It may have such a power: I am not disposed to deny it; but that it really has so we cannot safely infer from such circumstances. In this case it clearly has the power of arresting the deposition of lymph; of putting an end to the adhesive inflammation. Whether it does anything more towards completing the cure, we have these reasons for doubting. When blood chances to be effused into the anterior chamber; or pus; or when, as frequently happens, pieces of a cataract that has been broken up pass through the pupil, and show themselves between the iris and cornea; they (the blood, the pus, the fragments of the lens) disappear, i.e., are absorbed, just as rapidly as the lymph in syphilitic iritis, although not a particle of mercury is taken. Mr. Lawrence even gives a case of syphilitic iritis, which got well without any affection of the gums by mercury, and which had been marked by the deposit of a large mass of lymph on the iris; and he says that the lymph was immediately absorbed, as soon as the inflammation ceased; and that he never saw it disappear more quickly under any circumstances. It is important to know that different persons accept, or resist, the specific agency of mercury, in very different degrees; so that in some patients the remedy becomes unmanageable and hazardous, while in others it is almost inert. There are persons in whom very small quantities of mercury act as a violent poison; a single dose producing the severest salivation and bringing the patient's existence into jeopardy. This history was told to the late Dr. Farre by a medical man, under whose notice it fell. A lady whom he attended said to him, at his first professional visit to her, 'Now, without asking why, or speculating about it, never give me mercury, for it poisons me.' Some time afterwards she met with the late Mr. Chevalier, and spoke to him about her complaints; and he prescribed for her, as a purgative, *once*, two grains of calomel, with some cathartic extract. She took the dose, and the next morning showed the prescription to her ordinary attendant. 'Why (said he) you have done the very thing you were so anxious to avoid; you have taken mercury.' She replied, 'I thought as much, from the sensations I have in my mouth.' Furious salivation came on in a few hours; and she died at the end of two years, worn out by the effects of the mercury, and having lost portions of the jaw-bone by necrosis.

Another medical man informed me that he knew a person so susceptible of the influence of mercury, that when his wife had rubbed a very small quantity of white precipitate ointment upon her neck, for some cutaneous affection, his gums were tender for three or four days, after his sleeping with her; and slight salivation took place. This did not happen once only, but three several times. On one occasion this same man took two blue pills, as preliminary to a common purge, and he was salivated profusely for six weeks. Cases similar to these occur now and then to most medical men; we cannot tell beforehand in whom such effects are to be looked for, but it is never prudent to neglect any warning which the patient gives of his own previous experience on this point. You will generally find that where the affection of the gums and salivary organs goes on to a troublesome or distressing extent, it has supervened upon the employment of a very moderate quantity of mercury.

So distressing sometimes are these effects of mercury upon the mouth, that although they are much less commonly seen now-a-days than heretofore, I may pause a moment to tell you what I know about the means of remedying them.

Having tried various expedients myself, and having asked many of my friends what is the best plan to adopt in such circumstances, I will mention those which have seemed most eligible. In the first place, if there be much external swelling, treat the case as being, what it really is, a case of *local inflammation*; apply a few leeches beneath the edges of the jaw bones, and wrap round the neck a soft poultice, into which the orifices made by the leeches may bleed; and I can promise you that, in nine cases out of ten, you will receive the thanks of your patient for the great comfort this measure has afforded him. I have found few things more generally useful or more convenient than a domestic gargle or wash made of brandy-and-water; in the proportion of one part of brandy to four or five of water. I have been told, that in the Dreadnought Hospital Ship, Mr. Busk has been in the habit of touching the swollen gums with the undiluted hydrochloric acid, with the effect of speedily curing them and stopping the ptyalism. It is applied by means of a little cotton wool, or lint, wrapped round a stick of wood, and so passed quickly over the surface of the gums and the sides of the tongue. I have his own authority for saying that this application was always attended with good effects, and never had any evil consequences. Pure tannin moistened and smeared upon the spongy gums, is also efficacious in rendering them firmer and more comfortable. These for external use. For internal, the chlorate of potash, in half-scruple doses every four hours, has been much praised,—so also has sulphur: and Mr. Jukes de Styrap, formerly a student in this college, writes me word that a combination of these two drugs, ten grains of each, taken at the same intervals, has proved in his hands almost a specific.

I have been speaking of the use of mercury in inflammation. It is a most valuable remedy in various other complaints; but, like all drugs that have power to do good, it has power also to do mischief. Persons who are kept long under its influence, even when no salivation is produced, are apt to waste, and to grow pale. The late Dr. Farre, who had paid great attention to its effects, remedial and injurious, held that it rapidly destroys red blood; as effectually as it may be destroyed by repeated venesection. As an instance of this, he was in the habit of relating in his lectures the case of a lady who had been attacked with hematemesis, and whose gastric system and liver were gorged with blood. "Her complexion," said the doctor, "was compounded of the rose and the violet. Under a course of mercury she was blanched, in six weeks, as white as a lily." For anæmic persons, therefore, we prescribe mercury cautiously, if at all. Its use is to be avoided in cases of erysipelatous inflammation having a tendency to gangrene; in scrofulous diseases; in inflammatory complaints attended with general debility, and an irritable condition of the nervous system, or a manifest disposition to take on a low and typhus-like character.

In the digression which we have made from our main subject of general pathology, we have learned how important it may be to ascertain the cause of a disease, in order that we may rightly direct its treatment. Also, how greatly inflammation may be modified in its behaviour and tendencies by the pre-existing condition of the body.

Another remedy which, in this general account of the treatment of acute inflammation, I must briefly notice, is *antimony*; and a very valuable remedy it is in some forms of inflammatory disease. Antimony, properly administered, subdues the action of the heart and arteries, producing nausea, paleness, and sinking of the pulse, with great relief frequently to the local symptoms. You bring the circulation into that state into which it may be brought by the free abstraction of blood. But when the violence of the inflammatory symptoms recurs again and again you cannot again and again resort to blood-letting: or if you do so with the view of at length extinguishing the inflammation, you incur the risk of reducing your patient to a state of pitiable, and even perilous, debility. Now you may continue or repeat the depression of the circulation by means of antimony, without any dread of such subsequent weakness. In inflammation of the mucous membrane of the air passages antimony is signally beneficial. You will see a patient labouring for breath, unable perhaps to lie down, with a turgid and livid countenance from imperfect arterialisation of the blood. He has been ill but a short time; it is an acute affection; and upon listening at his chest you hear that peculiar wheezing sound which we call *sibilus*, in every part of his lungs. I shall have to describe this sound, and its causes, and its meaning, in a future part of the course. You give such a patient repeated doses of antimony; he becomes sick, vomits perhaps, but he feels nausea: his pulse becomes less forcible, his face grows pale, and he can breathe again. The nausea is not a pleasant sensation; but the want of breath is a far more distressing one; and that is greatly mitigated. Perhaps free secretion takes place from the congested membrane, and then the patient is easy and safe.

On the other hand, antimony does not appear to be nearly so valuable a remedy when serous membranes are inflamed.

As to the form in which the antimony should be exhibited, I apprehend that we shall all come at last to freshly-dissolved tartar emetic. The antimonial powder is of very uncertain strength; and the antimonial wine contains too much spirit to allow of its being given in large and frequently-repeated doses. It is a curious circumstance, that although vomiting and purging are apt to be produced by the first two or three doses, they usually cease when the same quantity is persevered with. *Tolerance* of the remedy is established. But while these unpleasant primary effects cease, the curative agency of the antimony appears to continue. When you desire to obtain its full influence in a short time, you may dissolve a grain of the tartar emetic in two ounces of hot water, and give a fourth part of the solution every half-hour. If the patient become pale and sick, you pause awhile and allow him to recover himself; and if the inflammatory symptoms return, you repeat the medicine. It sometimes acts violently upon the bowels, and then it is necessary to add a few drops of laudanum to each dose.

Ipecacuan is another valuable medicine, of which the effects are analogous to those of antimony. Its operation, in nauseating or emetic doses, is less violent, less enduring, and less depressing than that of antimony ; neither is it so likely to irritate the bowels, and cause diarrhœa. It is, therefore, generally to be preferred to antimony in the treatment of inflammatory affections of the bronchial and pulmonary mucous membranes in *children*.

I have formerly been asked, by students attending here—and therefore I anticipate the question now—respecting the utility of *opium* as a remedy in inflammation. Certainly opium, like mercury, may be very serviceable, as it may be very prejudicial, in different inflammatory diseases ; and it is not very easy to point out clearly, in a general view of the treatment of inflammation, the rules for its administration by which we must be guided in different cases. Yet there are a few general observations which I may make now on this subject.

The administration of a full dose of opium has been strongly recommended after effective bleeding to such an amount, as the case may have seemed to require. It prevents the rekindling of the inflammation which is apt to result from irritation of the nervous system—a kind of irritation, you will remark, which a copious abstraction of blood is calculated sometimes to produce, or to augment if it find it already existing. The opium soothes this nervous irritability ; and it must be given, when given at all, in doses which will have that effect. It is best adapted to those cases in which a natural irritability is inherent in the constitution of the patient—to those in which such irritability has been acquired by bad habits of life—and to those in which the local disease is attended with much *pain*, which is in all constitutions a source of irritation.

However, this is a remedy which requires to be used, in inflammation, with great caution and discrimination. In cases of active inflammation within the cranium, its propriety is very questionable. It is apt to confuse both the patient and his physician, who is unable to say, after a full dose of opium has been given, how much of the stupor that may follow is owing to the disease, how much to the drug. It is a very ticklish remedy in pectoral inflammations. I believe that by the free use of opium I saved the life of a relation of my own, an old lady, who was in danger of being worn out by the cough and bronchial affection which attended the influenza. On the other hand, I certainly have known of more than one person, labouring under extensive and severe bronchitis, who have been so effectually quieted by a dose of the same medicine, that they never woke again. As a general rule, I should say that you must be very careful how you venture upon opium in inflammatory diseases that tend to produce death by *coma* or by *apnœa*. If there be any unnatural duskiness of the face, if ever so slight a tinge of purple mingle itself with the red colour of the lips, this is an appearance which (with certain exceptions, to be specified hereafter) should warn you against opium. It shows that the blood is imperfectly arterialised; and imperfect arterialisation of the blood, as I hope you all know now, either results from, or conduces to, a state of coma.

On the other hand, it is, *cæteris paribus*, in cases where the tendency is towards death by *asthenia*, that the use of opium, as a remedy for inflammation, is most serviceable. It has a capital effect often, after free bleeding, in cases of peritonitis, and of enteritis. It probably does good in various ways: by quieting the nerves—by sustaining the faltering action of the heart—by keeping the inflamed parts at rest. There are some frightful accidents in which we can expect little from bloodletting, but in which the judicious employment of opium affords some glimmering of hope. I allude to those cases of intense and general peritonitis which arise upon the escape of irritating substances into the cavity of the belly; the contents of the intestines, from ulceration or from external injury; urine from rupture of the bladder; and so on. If there be any hope in such cases, it is to be found in the continued exhibition of opium in considerable doses. But upon all these points I shall go more into detail when we come to consider individual diseases.

LECTURE XIV.

Hæmorrhage:—most commonly Capillary. Habitual Hæmorrhages. Vicarious Hæmorrhages. Idiopathic Hæmorrhages. Active and Passive. Symptomatic Hæmorrhages. Usual Situations of Hæmorrhage. Symptoms and Diagnosis. Principles of Treatment.

In the course of that somewhat cursory account which I have been endeavouring to give you of the general facts and doctrines of pathology, as a preparation for the better understanding of special forms of disease, we reached, some lectures back, the subject of local plethora, or congestion. From that point our road branched off in three several directions. We have pursued the first and main branch to its termination; that which led to the discussion of inflammation. We must now go back to the same point again, and follow first the one and then the other of the two remaining tracks, which conduct respectively to the consideration of *hæmorrhage* and of *dropsy*. These tracks are shorter than that along which we were last travelling; but they are not uninviting; they will open to us, if I mistake not, some interesting views of the country of which we purpose, in the end, to make a more particular survey.

You are to observe that I treat of *hæmorrhage*, only so far as it falls to the care of the *physician*. The subject is exceedingly full of interest in its relation to surgery: and it will receive at the hands of my colleague all the attention which its great importance, as a surgical accident, demands.

But *we* also, as physicians, have much to do with hæmorrhage; with what, for distinction's sake, I may call *medical* hæmorrhage; which differs in kind, in cause, in its consequences, and in the treatment it requires, from that which surgery contemplates.

In most cases of surgical or traumatic hæmorrhage the blood flows from some considerable vessel, which has been cut, or torn, or somehow ruptured. You would greatly mistake if you inferred from that circumstance (as you naturally might) that it is *usually* so—the only difference being in the situation of the vessel—in medical hæmorrhage also.

Yet that is the popular notion. When blood gushes out from internal parts, through any of the natural apertures of the body, the person is said and supposed to have *broken a blood-vessel.*

But this is rarely, though it is sometimes, the case. In nine instances out of ten, if there be any rupture at all, it is rupture of numerous capillaries only: but even of this there is often no palpable evidence. Blood may exude abundantly from a surface which presents, to the naked eye at least, no appreciable injury or change.

When, for example, hæmorrhage has occurred so profusely from the stomach or bowels that the death which ensued could be sufficiently accounted for by the mere loss of blood, the whole tract of the alimentary canal has been diligently scrutinized, and has exhibited no ruptured blood-vessel, no breach or abrasion even of its surface, nor any perceptible alteration of texture. Sometimes its mucous membrane appears, here and there, of a red colour, and, as it were, charged with blood. Sometimes it is pale and transparent, while the vascular network visible immediately beneath it is gorged and turgid. Sometimes the whole is colourless, the same network of vessels having been completely emptied by the previous hæmorrhage.

The same thing is true of other surfaces of the body: nay, in some rare cases, the process of transudation has been actually witnessed. There are well-authenticated instances on record of *cutaneous* hæmorrhage; where a dew of blood, or of its colouring matter, has appeared upon some portion of the skin, has been wiped away, and has reappeared; and that again and again, without any discernible change of the affected surface, beyond some occasional variation in its colour. Facts of this kind suggested the hypothesis that the exudation of blood from unbroken surfaces takes place precisely as sweat oozes from the skin, mucus from the lining of the bowels, and serum or synovia from the membranes that respectively furnish those fluids; and probably by the very same outlets. And this hypothesis, that the blood proceeds from the same exhalant vessels or apertures, which, in health, pour out the fluids natural to the part, appeared to receive support from the fact, that certain hæmorrhages are ushered in and succeeded by an increased efflux of the fluids which belong to the surface concerned. In hæmorrhages from the mucous membranes the following succession of events is, in some persons, habitual. First, there is an augmented flow of mucus alone; then of mucus tinged with blood; then of pure blood: and the hæmorrhage recedes by a similar but inverse gradation, towards a mucous drain, which itself at length decreases or disappears.

But I am assured by those whose knowledge of minute anatomy is much more accurate and trustworthy than mine, that the hypothesis of a mere *exhalation* of blood is untenable; that hæmorrhage from a surface without rupture of capillary vessels is physically impossible; that if the red corpuscles of the blood, which measure from $\frac{1}{4000}$ to $\frac{1}{3000}$ of an inch in diameter, could pass through lateral pores in those vessels, such pores must be large enough to become visible under the microscope. Nay, it is asserted that while it shows no such pores, the microscope does reveal a multitude of distended and broken capillaries in the texture of organs from which hæmorrhage has proceeded.

I give up therefore the phrase *hæmorrhage by exhalation*, which I have heretofore been accustomed to use in these lectures, and I adopt in its stead the less objectionable term *capillary hæmorrhage*. The distinction is broad enough between bleeding from a palpable leak in a large vein or artery, and bleeding from countless capillaries, whether these be torn or entire.

Now, although internal hæmorrhage may happen in other ways; as from the bursting of an aneurism, or from an opening made in a large vessel by progressive ulceration; yet in by far the greater number of cases it takes place from innumerable capillaries. Capillary hæmorrhage is the rule—other modes of hæmorrhage furnish the occasional exception.

I must exclude, however, from this general statement one very important hæmorrhage. In the brain, the former exception becomes the rule. In most cases cerebral hæmorrhage results from the rupture of a blood-vessel of appreciable magnitude.

There are various kinds of capillary hæmorrhage. I will bring them before you, in succession, as clearly and as concisely as I can.

In the first place there are hæmorrhages which, although they do not belong to the state of health, if we take mankind in general, yet when they do occur can scarcely be called diseases. There are some persons—I believe I may say there are many persons—who are subject during the greater part of their lives, to discharges of blood; which happen again and again, commonly at regular intervals, without any perceptible detriment to the general health, independently of any obvious exciting cause, and (as it would seem) from some inherent property or necessity of the system.

Hæmorrhages thus occurring, I will call *habitual hæmorrhages.* They proceed more commonly from the rectum, and from the nostrils, than from any other parts; although instances are recorded of their taking place from the bladder and from the bronchi. Appertaining to the original constitution of the body, this disposition to periodic hæmorrhage has been sometimes observed to be hereditary.

You will at once be struck with the analogy which obtains between these habitual hæmorrhages occurring in either sex, and the monthly discharge which is peculiar to the female. The analogy is even closer than it may at first sight appear: but it is more distinctly marked in some individuals, liable to habitual hæmorrhage, than in others. It was one of the singular notions of the celebrated phrenologist, M. Gall, founded upon this analogy, that there is such a thing as male menstruation. The points of resemblance between the two phenomena will be manifest in the following summary of the characters belonging to habitual hæmorrhage.

Like the catamenia, these hæmorrhages do not ordinarily prevail throughout the whole course of life. In most cases they do not commence before the period of adolescence; and they cease altogether, or recur at distant intervals only, in declining age. Their first eruption is sometimes preceded by a state of general indisposition, more rarely by slight febrile disturbance, and even (according to some observers) by a sort of chlorosis similar to that which affects young girls in whom the menstrual evacuation is delayed or suspended. The hæmorrhage sometimes occurs at precisely regular intervals, and by *monthly* periods more commonly than any other: being announced, on each occasion, by the same preludes, proceeding from the same part, continuing for the same space of time, and furnishing always about the same quantity of blood. Its accidental interruption is almost uniformly the cause or the consequence of some derangement of the health: and when it becomes excessive, it becomes, like too profuse menstruation, a disease.

It forms a very curious part of the general history of hæmorrhages that they are not unfrequently *vicarious*, or supplemental, sometimes of each other, but more often of the monthly discharge from the uterus. Women are liable to perverted menstruation (so to call it) through other channels than the natural one: and here again the analogy between the catamenia and habitual hæmorrhage comes into view. The hæmorrhages which belong to the constitution are apt to wander in their seat. As bleeding from the lungs, stomach, rectum, or skin sometimes follows upon the suspension of the menses, so bleeding from the bladder, from the mouth, and from other parts, has been occasionally observed to succeed the suppression of habitual hæmorrhoïs.

These hæmorrhagic deviations take place commonly by the same organ on each occasion; more seldom by different organs in succession. It is almost always in this supplementary manner that the rarer forms of hæmorrhage occur, and those of the skin in particular.

This singular migration, this interchange of place between certain hæmorrhages, seems calculated to throw some light upon the obscure doctrine of *revulsion*; a doctrine to which I have already more than once referred, and which, though it is very imperfectly understood, is of frequent avail in the practice of physic.

Vicarious hæmorrhage always denotes a disordered state of the general health; and must be considered, in itself, as a malady.

Again, there are certain forms of hæmorrhage, not habitual, which may be denominated *idiopathic*: inasmuch as they are apt to arise without any perceptible connection with antecedent local disease.

In other respects, however, they differ considerably, and require to be further distinguished: and the terms *active* and *passive*, which are in common use, will sufficiently express the two forms of idiopathic hæmorrhage that I wish to bring under your notice.

Active hæmorrhage is preceded by active congestion, and therefore is akin to inflammation; and it sometimes requires the treatment of inflammation.

Passive hæmorrhage often occurs without any apparent previous congestion of any kind. Hæmorrhage of this passive character has been ascribed to some change in the condition of the small vessels or channels through which the healthy exhalations are transmitted; the change being of the nature of morbid debility or relaxation. This view of the matter derives its chief support from the occasional efficacy of *astringent* substances (either applied locally, or taken into the system) in checking the effusion of blood, when other remedies have failed. But as we are forbidden to speak of hæmorrhage by exhalation, we may suppose that in these passive hæmorrhages the capillary blood-vessels have somehow become tender and fragile, so as to give way and spill their contents under the ordinary pressure of the circulating blood.

A more probable hypothesis perhaps is that which supposes some alteration in the condition and consistence of the blood itself; which thus becomes attenuated, and capable of passing through channels or orifices that healthy blood, under ordinary circumstances, cannot penetrate. We know that the serous ingredient of the blood may and does filter through the pores of the minute vessels, and we may conceive that with it may at the same time transude the hæmatosin or colouring matter of unhealthy blood; and this supposition is consonant with the fact that hæmorrhages are known to occur where the blood is more thin, pale, and serous than common: and still more remarkably where that fluid has undergone a demonstrable change in its chemical nature, or is even visibly altered in its sensible qualities; as, for example, in certain cases of purpura and of sea-scurvy. And hæmorrhages of this kind are often cured by measures calculated to repair the blood, to restore it to its natural condition by improvement in diet, or by food of a peculiar kind, such as the juice of lemons.

Whatever may be the true explanation of the differences in question, there can be no doubt that they exist, and are often strongly pronounced in cases of hæmorrhage, which, inasmuch as they cannot be traced to any pre-existent local disease, we class together as *idiopathic*. And it will be worth while to run over the distinctive characters of active and passive hæmorrhage, as in well-marked cases they are broadly and decidedly visible.

Active hæmorrhage (which is preceded, I repeat, by active congestion) occurs principally in persons who are young and robust, who live fully, and lead indolent lives, and are subject to the influence of those causes which tend to generate plethora. Occasionally the hæmorrhage can be traced to some exciting cause; it may be exposure to heat, strong mental emotion, violent exercise, or great bodily effort. More frequently, perhaps, no exciting cause is apparent. It is sometimes ushered in by a set of symptoms expressive of what has been called the *molimen hæmorrhagicum*. The patient experiences a general feeling of indisposition, with wandering and obscure pains that gradually settle in the part from which the blood is about to be discharged. A series of local symptoms, such as a sensation of weight, or of tension, or of heat and tingling, sometimes a slight degree of turgescence and redness, and a visible fulness of the larger veins, indicate the afflux of blood towards the labouring organ, and the parts in its vicinity: while chilliness, paleness, and shrinking of distant parts, and especially of the feet and hands, denote an opposite condition of the circulation in *them.* And to this state of things there often succeeds a general increase of heat, with a frequent, full, and bounding *pulse*—a pulse which is so characteristic sometimes, as to have acquired a name: you may often hear or read of a *hæmorrhagic* pulse. The blood, when at length it breaks forth, commonly escapes with rapidity; is of a florid colour; proceeds from a single organ; and readily coagulates, though it does not always separate distinctly into serum and crassamentum. While it is flowing, the signs of local congestion diminish and disappear; warmth returns to the extremities, and the pulse regains its natural strength and frequency. The patient acknowledges a sensible relief, and feels stronger and more lively than before. This kind of hæmorrhage is, in some sort, its own remedy; it ceases in virtue of the discharge of a certain quantity of blood, and it is followed by morbid consequences only when that quantity has been excessive, or when it inflicts some mechanical injury upon the parts along which the blood passes.

I said that active hæmorrhage is preceded by active congestion, and is consequently akin to inflammation. Perhaps it may be more true that in some of these cases we actually have the initial stage of inflammation, of which the hæmorrhage proves the natural cure; strangling it in its birth: that remedy being applied, in the very moment when it is most effective, which I told you, in the last lecture, was the most potent of all the remedies of inflammation, namely, *early loss of blood.*

Passive hæmorrhage on the other hand is characterised by circumstances of an exactly opposite nature. It occurs in those who are naturally feeble, or who have been debilitated by disease, fatigue, insufficient nourishment, great evacuations, or the depressing passions. It is not, in general, announced by any precursory symptoms, nor attended by any reaction. The effused blood is of a dark colour, serous, and but little disposed to coagulate: and it often is poured forth from several parts of the body at the same time. If the quantity lost be at all considerable, the natural debility of the patient is rapidly increased: his face becomes pale, and his body loses its heat. The hæmorrhage leaves him in a worse condition than that in which it found him. The flow of a certain quantity of blood is not, as in the cases of *active* hæmorrhage, suspensive of its further effusion; frequently, indeed, passive hæmorrhage resists the means opposed to it the more, in proportion as it has continued longer, or has been more profuse.

There are some persons who bear what is called a hæmorrhagic diathesis, a disposition to bleed persistently on the reception of slight injuries, such as a superficial scratch, or the extraction of a tooth, even friction of the gums with a stiff tooth-brush. This is an exaggerated form of passive hæmorrhage. The blood wells forth incessantly, and is staunched with extreme difficulty. This propensity to bleed runs often in families; is an inherited propensity. The persons thus constituted are very easily bruised; ecchymosis occurs on mere and slight pressure, or perhaps spontaneously; the bruises and ecchymoses giving evidence of subcutaneous hæmorrhages, small in amount, from delicate and fragile blood-vessels. It is a curious fact connected with this form of hæmorrhage that the 'bleeders' are sometimes subject to painful swellings of the joints, resembling those of rheumatism. The tendency, while it continues, renders life precarious; but it seems sometimes to wear out as time goes on.

Hæmorrhages of the kind I have now been describing—that is to say, depending upon no palpable disease of any organ, and, therefore, idiopathic—are of no uncommon occurrence, whether we regard the active or the passive form in which they appear: but by far the greater number of capillary hæmorrhages are *symptomatic*; that is, they result from some previous disease, either in the organ from which the blood proceeds, or in some other organ connected therewith by community or dependence of function.

The secondary or symptomatic hæmorrhages are preceded by congestion, but for the most part the congestion is not of the active, but of the mechanical kind; and has more to do with the veins of the part than with the arteries.

Thus we have hæmorrhage from the bronchial membrane, or from pulmonary vessels, in consequence of crude tubercular matter in the lungs filling up a portion of the lung tissue, and obstructing the circulation of the blood through it. This is an example of symptomatic capillary hæmorrhage, depending upon previous disease in the organ itself from which the blood proceeds.

In some of these cases the presence of pyrexia renders it probable that the hæmorrhage is the consequence and the relief of active congestion, provoked by the irritation of tubercles;

rather than the result of a mechanical obstruction of the circulation.

Again, we have hæmorrhage into and from the lungs, as a consequence of such disease of the heart as mechanically impedes the return of the blood from the lungs to that organ: a narrowing of the mitral orifice, for instance. Here the blood is barred up, as it were, in the lungs, till at length the capillaries, incapable of further distension, are lacerated under the internal stress. In precisely the same way blood is poured out from the mucous membrane of the stomach and bowels, in consequence of disease in the liver, obstructing the portal circulation. These are examples of symptomatic hæmorrhage, depending upon previous disease, not of the organ itself from which the blood proceeds, but of another organ intimately connected with the former.

When I say that hæmorrhage into and from the lungs may result from such disease of the heart as implies an impediment to the circulation, you must not suppose that the lungs are the only channel through which the mechanical congestion can be relieved. Disease of the central moving organ of the circulation leads often, at length, to *universal* venous congestion: and the hæmorrhage, which is apt to be the consequence of such congestion, may burst forth from any part where the veins are so overloaded. Hæmorrhages from various portions of the mucous membranes are in truth very common effects of cardiac disease.

The influence of mechanical congestion as a direct cause of hæmorrhage is sometimes very distinctly seen in the bodies of persons who have been hanged. You know that when suffocation has been produced by suddenly cutting off the access of air to the lungs, the right side of the heart, the great veins, and indeed the venous system generally, become loaded and distended with dark blood. Dr. Yelloly examined the stomachs of five men who had been executed by hanging: he found them all exceedingly vascular: and in two of the five cases, blood was actually extravasated, and adhering to the surface of the membrane. There had been, in short, unequivocal hæmorrhage.

There are several things, worthy of notice, in respect to capillary hæmorrhage, of whatever kind.

In the first place, it occurs much more frequently and readily from some tissues of the body than from others: and most especially of all, from *mucous* surfaces. Thus we have hæmorrhage from the mucous membrane lining the nasal cavities; from the pulmonary mucous membrane; from the stomach and bowels; from the urinary organs; and from the uterus: constituting distinct forms of disease, which we are, by and by, to investigate more particularly. *Epistaxis, hæmoptysis, hæmatemesis, melæna, hæmorrhoïs, hæmaturia, menorrhagia,* are names descriptive of hæmorrhage, as it is apt to occur from different parts of one or other of the three tracts of mucous membrane met with in the body: and you will find that these comprise very nearly all the complaints enumerated by nosological writers under the head of hæmorrhage.

Now this is a very remarkable fact: and very interesting questions arise out of it. Has it any relation to the manner in which these membranes, and the tissues subjacent to them, are supplied with a capillary circulation? or may the fact be explained by the laxity of their attachment, which facilitates and favours the accumulation of blood in the vessels of the submucous tissue? or do the minute blood-vessels belonging to the mucous membranes receive a less firm support from the tissue in which they lie, than those belonging to membranes of closer texture? Whatever answers may be given to these questions, you will do well to recollect the fact which has suggested them.

Capillary hæmorrhages are not, however, exclusively confined to mucous surfaces. They are liable to occur, but much more rarely, from serous membranes. In the majority of cases, however, in which blood is found effused into any of the serous sacs, it has either been an event of inflammation, or the blood has been poured out from an accidental opening in some considerable vessel. Cutaneous hæmorrhage is also very rare; probably because the cuticle opposes a barrier to the exit of the blood: for the little red spots which characterise purpura are in fact hæmorrhages, although the blood has not penetrated the epidermis. There are cases, however, as I mentioned before, in which blood has transpired, in a sort of dew, from the external surface of the body.

Another important general fact in respect of capillary hæmorrhages is, that they proceed more frequently from certain parts of the mucous membranes than from others, according to differences of *age*. Thus in children they are most common from the membrane that lines the nasal cavities; in youth from the mucous membrane of the lungs and bronchi; in the middle years of life, and towards its decline, from the rectum, uterus, and urinary organs. I should add here, from the blood-vessels of the brain, in old age; except that this, as I have already intimated, is not (speaking generally) *capillary* hæmorrhage.

This variation of the tendency to capillary hæmorrhage according to different periods of life is subject to exceptions.

Of course when I say that, in the instances specified, the blood is *commonly* poured out by the capillaries, you will understand that the hæmorrhage *sometimes* occurs from the laying open of a single vessel of some magnitude. Thus hæmorrhage from the fauces may be the result of ulceration there, which has penetrated the coats of a vein or artery: hæmoptysis is occasionally produced by the laceration of a large blood-vessel during the softening and expulsion of tubercles: hæmatemesis sometimes is the consequence of a breach made in a considerable blood-vessel during the progress of cancer of the stomach, or by the extension of small corroding ulcers: hæmorrhage from the bowels is no uncommon effect of ulceration, such as happens in fevers, of the mucous follicles of the small intestine: calculous matter in the kidneys will often lead to the rupture of some of the blood-vessels there, and to the discharge of blood by the urethra. Aneurisms also may burst into almost any part of the body. But events of this kind are unfrequent when compared with capillary hæmorrhages from the same internal parts.

In the head, however, the ratio is reversed. Blood does sometimes, I believe, proceed from the hair-like vessels of the brain or of its membranes, but much more commonly cerebral hæmorrhage is caused by the giving way of a diseased *artery* in the brain.

How, in all these cases, to distinguish whether the blood has oozed out by many small ruptures from a surface, or has escaped from a hole in the sides of a vein or artery, will form matter for future enquiry. Sometimes we *can* make the distinction; and sometimes, it must be confessed, we cannot.

You will readily understand that hæmorrhage must vary greatly, in regard to its importance, and to the danger which it implies, according to the part from which it proceeds, and the circumstances under which the blood is poured out. It sometimes happens that death ensues from the mere loss of blood; either at once, by one profuse bleeding, or more slowly, by repeated bleedings which we are unable to restrain: but this is comparatively rare, and when it does happen, the blood is generally found to have proceeded from one considerable vessel, which has been ruptured or eroded. The case approximates to traumatic hæmorrhage, except that we cannot cut down upon and tie the injured vessel. Much more commonly danger arises from the presence and pressure of the extravasated blood in and upon internal parts: upon the brain, for example, in cerebral hæmorrhage; in the lungs, in pulmonary.

The symptoms also are liable to much variation in different cases. Even the diagnosis of hæmorrhage is not always equally easy or certain. When the part into which the blood is directly poured communicates with the exterior of the body, the expulsion of some of that fluid will, generally, sooner or later, demonstrate the case to be one of hæmorrhage. I say *generally*, because cases have been known to occur, in which patients, previously in a state of great weakness, have died outright, by syncope, from the mere extravasation of blood, and before any of it had made its way out of the body. The stomach and bowels have been found full of blood, when none had passed either by vomiting or by stool. And when the blood does make its appearance outwardly, it is sometimes not easy to determine whether it has come from a certain organ, or from the parts that lie between the same organ, and the natural outlet by which the blood ultimately escapes. For instance, it is sometimes a matter of uncertainty whether the blood, in hæmaturia, proceeds from the kidneys, or the bladder, or the prostate gland, or the urethra.

The blood itself, when it reaches the exterior, will generally be more fluid, and brighter, in proportion as it is effused in greater quantity, and nearer the surface; more in clots, and darker in colour, in proportion to the length of time that it has remained within the body after its escape from its proper vessels: and this length of time may depend upon the smallness of the quantity of blood effused, and the consequent tolerance of the organs through which it may have passed; or, upon the actual space traversed. Respecting the *colour*, however, of the effused blood, I shall have some curious explanations to offer you when I come to speak of hæmatemesis as a disease. It would be superfluous to enter upon them now.

If the site of the hæmorrhage do not communicate with the external air, we are without that certainty which results from the actual spectacle of the blood. But in such cases we are much assisted by local disturbances of function, springing from the pressure upon, or the laceration or distension of, the suffering organ, or of the parts contiguous to it. And we may derive good information from observing the indirect symptoms which declare themselves through the system at large; many of which indirect symptoms are the same whether the blood reaches the exterior or not. They principally vary according to the quantity of blood poured out, and to the *rapidity* of its effusion; and some difference will occur according to the age and strength of the patient.

Some of these indirect symptoms have not always been imputed to their true cause. Paleness of the face and lips, feebleness of the pulse, coldness of the extremities, giddiness, and a tendency to syncope—symptoms which are apt to be connected with hæmorrhage—have sometimes been ascribed to the alarm and sense of danger which the sight of the blood is calculated to produce on the mind of the patient. This may, to a certain extent, be sometimes true; but the explanation cannot apply to those cases in which the hæmorrhage is strictly confined to the interior of the body, yet in which the symptoms just alluded to are often strongly marked. They *then* depend—and probably in all cases they *chiefly* depend—upon the actual abstraction of the blood from the circulation.

When the hæmorrhage proves fatal—when the sufferer 'bleeds to death,' the death is preceded by the symptoms which I enumerated in a former lecture, while speaking of *death by anæmia*; by pallor, faintness, cold sweats, dilated pupils, dimness of vision, noises in the ears, tossing, restlessness of the limbs, sighing, gasping respiration, delirium sometimes, nausea sometimes, and almost always by convulsions.

The management of individual cases of hæmorrhage must be mainly regulated by the particular circumstances under which they occur. The few observations that I have at present to make respecting their treatment cannot be otherwise than very general.

But a preliminary question, of some importance, presents itself. Is it in all cases of hæmorrhage proper, or safe, to attempt to stop the bleeding?

Without going into detail, it may, I think, be laid down as a rule, that what I have called habitual hæmorrhages ought not to be interfered with, so long as they have no perceptible injurious influence upon the health, and so long as they proceed (as they mostly do) from parts of which the *structure* is not likely to be spoiled, nor the *function* impaired, by the repeated passage of the blood. The most common seat of these habitual hæmorrhages I have stated to be the rectum;—to which the two conditions just mentioned are, fortunately, both of them applicable. Epistaxis supplies a less frequent example of the same kind. When they deviate from their usual channel, and are transferred (as it were) to some more important organ, it will generally be right, among other remedial measures, to endeavour to *recall* the original hæmorrhage. It is very seldom that the metastasis takes place *for the better*—i.e., from a part where the bleeding is attended with danger, to one where it is comparatively harmless.

However, when these habitual hæmorrhages happen, as they often do, in plethoric persons; and when they are urged and kept up, as they frequently are, by intemperate and luxurious habits; we ought not to content ourselves with merely looking on. Hæmorrhoïs often performs the office of a safety-valve in such persons; and there are many who have what are called bleeding piles, and who would rather continue to have them, than submit to any change in their mode of life, or to the employment of other means of evacuation. Certainly these are cases in which nothing should be done to stop the bleeding; yet such patients ought to be told that the hæmorrhoidal discharge is but a precarious, and often an inadequate relief of the plethora; that while the plethora is suffered to exist there is danger of a cessation of the piles, and of the supervention of serious or fatal affections of other parts, and especially of the head. Apoplexy, from cerebral hæmorrhage, has frequently been known to follow hard upon the suspension of constitutional hæmorrhoïs. These patients should be admonished also that the discharge of blood from the vessels of the rectum may become excessive; that if it be aggravated by exercise or in any other way, it may lead to inflammation about the anus, and to great inconvenience; and that there are safe and tolerably sure methods of getting rid of the plethora (which is what chiefly constitutes the danger of such cases), if they will submit to the observance of them. It is in the intervals between the hæmorrhages that the danger of which they are in some sort the token may best be met.

Again, it will seldom be proper to employ *direct* expedients for stanching the flow of blood, in the small class of active idiopathic hæmorrhages; unless the quantity lost is so great as to endanger the safety or the well-being of the patient. Such hæmorrhages have commonly a tendency to cure themselves, by relieving the general plethora, or the local congestion, on which they depend. For these hæmorrhages, which bear so strong an analogy to inflammation, the *treatment* of inflammation may sometimes be requisite, as an indirect mode in which their amount may be moderated, and their recurrence combated.

With these exceptions, both direct and indirect measures are to be used, for arresting the effusion of blood as speedily as may be.

To this end, the patient is to be surrounded as much as possible with cool, fresh air, and kept in a state of absolute quiet. All motion of the body and emotion of the mind, all kinds of stimulating food and drink—everything, in short, which has a tendency to hurry the circulation, should be diligently avoided; and that position of the body should be chosen which is the least favourable to the afflux of blood towards the part affected. The horizontal posture will be proper in hæmorrhage from the bowels, the uterus, or the urinary organs. In epistaxis, and in cerebral hæmorrhage, the head should be raised.

In one word, that *regimen* which I spoke of as appropriate in the outset of acute and serious inflammation, should be strictly enjoined in all cases of hæmorrhage sufficiently severe to require medical assistance.

Of the actual remedies used for checking the further escape of the blood, one of the most important has already been alluded to—I mean the abstraction of blood. Herein we are guilty of homœopathy; to prevent bleeding, we draw blood. After what was stated respecting the use of blood-letting in inflammation, I need not dwell upon the objects aimed at by this measure: they are, briefly, to remove local congestion, and to divert the current of the blood from the suffering organ. Even venesection to a moderate amount may sometimes be available in abating the propulsive force of the heart's contractions, and in lessening general vascular tension or plethora, when it is present. The method, and the amount, and the repetition of the blood-letting, must of course be regulated by the circumstances of each particular case. And the same objects may sometimes be effected by other modes of general depletion, especially by the use of purgative medicines.

Next to blood-letting, *astringents* constitute the great resource against actually existing hæmorrhage: and among these, *cold* is one of the chief. It may be placed in direct contact with the bleeding surface:—as when ice is swallowed to restrain hæmatemesis; or cold water injected into the rectum in excessive and exhausting hæmorrhoïs; or into the vagina, in flooding from the uterus. Or it may be applied to the surface of the body, as near as possible to the seat of the hæmorrhage; as to the nose and forehead in epistaxis; to the chest in hæmoptysis; to the epigastrium in hæmorrhage from the stomach; to the lower part of the abdomen, or to the perinæum, in hæmorrhage from the intestines, uterus, or urinary organs. But the influence of cold in constringing the smaller vessels is not confined to the part with which it is in contact; it will stop hæmorrhage by the sympathetic shrinking which it produces in distant parts. Epistaxis, for example, has often been arrested by the sudden apposition of cold water to the neck, back, or genital organs. The nursery remedy consists in slipping a cold key down the back between the clothes and the skin.

Of even the mischievous power of cold in this way we have continual illustration in the suppression of the catamenia by cold and wet accidentally applied to the feet.

There is a long catalogue of medicinal substances which are esteemed to possess more or less of a specific virtue, when taken internally, in checking the flow of blood. Most of these are of an astringent nature, and some of them are eminently useful. The acetate of lead enjoys, in this country, a higher character, perhaps, than any other of these substances.

Many vegetable matters, and some artificial compounds, frequently employed in internal hæmorrhages, seem to owe their astringent and styptic properties to the tannic and gallic acids which enter into their composition. Such are the rhatany root, uva ursi, bistort, tormentil, the pomegranate, kino, catechu, the several preparations of gall-nuts, and the nostrum called *Ruspini's styptic.* It is better, however, in appropriate cases, to give the gallic acid itself, which may now be obtained in substance, in the form of a gray crystalline powder. The tannic acid is the most powerful styptic of the two, when applied directly to a bleeding surface, but when swallowed, it is converted into gallic acid before it can reach distant organs.

The power of arresting internal hæmorrhage has also been confidently ascribed, by different persons, to nitre given in large doses, to the mineral acids, to arnica, to the muriated tincture of iron, to alum, to the oil of turpentine, to the secale cornutum or spurred rye, to the matico leaf, and to various other substances, a more particular account of the rules and indications for administering which, I may return to, when I have to speak of individual hæmorrhages.

LECTURE XV.

Dropsy: its General Pathology. Passive Dropsy; Cardiac, and Renal. Active, Acute, or Febrile Dropsy. Prognosis; and General Principles of Treatment in Dropsies.

There remains now one subject only, of the pathology of which it will be convenient, and, I hope, instructive, to take a short general view, before we enter upon the consideration of special diseases. I proceed to speak of *Dropsies*: by which I mean collections of serous liquid in one or more of the shut cavities of the body, or in the meshes of the areolar tissue, or in both, independent of inflammation.

We have already considered serous effusion when it occurs as an effect or event of inflammation. We are commonly able to say of this, that it *has* originated in inflammation; either from its being mixed with some of the less equivocal *products* of that disease, such as coagulable lymph; or from its having taken place while *symptoms* of inflammation existed. But there are numerous examples of serous accumulation, which cannot with any show of reason be regarded as events of inflammation. It is to these that I would apply the simple term dropsy. The liquid collected is serous; it is not the liquor sanguinis; it holds no fibrin in solution. This is one main distinction, which you will do well to bear in mind, between the generality of inflammatory serous effusions, and dropsies.

It has been said—and said with much truth—that dropsy is rather a symptom of disease, than a disease in itself. And it has been affirmed that it would be more philosophical and scientific to treat of the original malady upon which the effusion or accumulation depends; to erase dropsy from the list of substantive diseases, and to place it in the catalogue of mere symptoms.

But this, to my mind, is a very mistaken view of the matter. For, first, it is oftentimes uncertain, while the patient is yet alive, what or where the primary disease may be; and even after death we sometimes can discover no organic change that would satisfactorily account for the effusion. Practically speaking, in such cases the dropsy *is* the disease, and the sole object of our treatment.

And, secondly, dropsy is, in fact, to a medical eye, in *all* cases, something more than an effect or symptom of disease. The imprisoned liquid is often a *cause* of various other symptoms; embarrassing, by its pressure, important functions, and even extinguishing life. The removal of the dropsy (although its original cause, of which it was a symptom, may remain behind, untouched, to be again productive of effusion under circumstances favourable to its operation)—the removal of the dropsy will often restore a person to comparative comfort; or even to what, so far as his sensations, and powers, and belief are concerned, *is*, to him, for the time, a state of health.

You see, then, already, that in a dropsical person, whose dropsy depends upon organic disease, there are two sets of symptoms to be distinguished: those, namely, which depend on the primary disease, and those which depend on the collected fluid. The latter, often the most grievous, may often be got rid of: the former, frequently permanent, are frequently also but little complained of or felt by the patient, until effusion is superadded.

Some persons, I fancy, have regarded dropsy as a less attractive subject of investigation than it might be if it were less frequently, in its nature, incurable. But so far as the dropsy itself is concerned, the complaint often *is* curable; and there are some forms of dropsy that are curable in a more absolute sense: that is, both the effusion, and that condition which was the physical cause of the effusion, are sometimes remediable.

Besides, it is our business to cure when we can; but whether we can cure or not, to relieve and palliate human suffering; and this, under Providence, we are able to do, in many or most cases of dropsy, to a very considerable extent.

Wherever there is a shut sac, or wherever there is loose and permeable areolar or connective tissue, there we may have dropsy.

Thus there may be dropsy of the ventricles of the brain, or of the meshes of the pia mater, leading to death by *coma*: of the pleuræ, of the areolar texture of the lungs, or of the submucous areolar tissue of the glottis, any of which may cause death by *apnœa*: of the pericardium, producing death by *syncope*. I mention these instances in particular, to show that almost every mode of dying may result from dropsical effusion; and to win your attention to a disorder so full of peril.

When the cerebral ventricles are distended with water, we express the diseased condition by the term *hydrocephalus*.

When serous liquid collects in the pleuræ, or in the pericardium, we say that the patient has *hydrothorax*, or *hydropericardium*. If the cavity of the peritoneum be the seat of the effusion, we call the complaint *ascites*. When the areolar tissue of a part becomes infiltered with serous fluid, the part is said to be *œdematous*; and *anasarca* is the name given to the more or less general accumulation of serum within and amongst the areolar tissue throughout the body, and especially to visible subcutaneous œdema of considerable extent. Finally, the term *general dropsy* signifies the combination of anasarca with dropsy of one or more of the large serous cavities.

Other local dropsies indeed there are; but as they belong entirely to surgery, I need not enumerate them.

Now what reasonable account can be given of these remarkable conditions? How is it that the hollows and interstices of the living body, or of parts of the body, become thus waterlogged?

To solve this question, we must carry in our minds some physiological recollections.

The closed cavities, or the interstitial tissues, within which the fluid of dropsy is confined, are kept moist, during life and health, by a continual serous exhalation from their surfaces, and they are kept *merely* moist, for the fluid thus constantly exhaled is as constantly reabsorbed into the circulation.

When these tissues or cavities, without having undergone inflammation, become filled and distended with the serous fluid which they habitually exhale, one of three things must have happened. Either the quantity of fluid exhaled has been augmented, the absorption remaining the same; or the absorption has been diminished, the exhalation continuing the same; or else the exhalation has been increased, while at the same time the absorption was either lessened or not proportionally increased.

The last is a mixed case; and we need only consider the two others.

Now the balance between exhalation and absorption is often deranged, and dropsies do actually arise, in each and all of these ways.

It will best suit my purpose to speak first of those dropsies which are occasioned by defective absorption, and which are usually called chronic or passive dropsies.

The direct agency of the blood-vessels in the production, as well as in the removal, of dropsy, although indicated by many common and obvious facts, has not been generally recognised till a comparatively recent period. Perhaps I should rather say that more importance used to be assigned, in these respects, to the agency of the lymphatic absorbents, than they are really entitled to. You will find that pathologists, even in modern times, speak of a want of tone, of deficient energy, in the absorbents, as a cause of dropsical accumulations; the superfluous fluid of the part is not adequately taken up (they say) by the enfeebled absorbents, meaning the absorbents strictly and anatomically so called. And this view of the matter, connecting dropsy always with debility as its cause, has led to a corresponding plan of treatment: the object aimed at being the stimulation of the absorbents to more energetic action.

But to the doctrine that dropsy is a consequence of the deficient action of the absorbents, this obvious objection presents itself,—that absorption really goes on, and goes on very actively, in dropsical patients: their adipous matter disappears, they become wretchedly thin. There is no complaint in which wasting and emaciation go to a greater extent than in dropsy. You will find also that persons labouring under anasarca are readily enough affected by mercury; which must of course be absorbed before it can produce any of its specific effects.

It must be confessed that our knowledge respecting the mechanism of absorption is neither complete nor certain; but there is good reason for supposing that the process is shared among the lacteals, the lymphatics, and the *veins*; and it is probable that it may be distributed between these sets of vessels somewhat after this manner;—that the lacteals absorb the chyle from the surface of the alimentary canal, and convey into the blood the materials of its renovation; that the office of the lymphatics is to take up and carry into the blood those old and effete portions of the solid constituents of the body, which require to be removed to make way for the arrival of fresh tissue-material; while the veins imbibe the serous fluid exhaled from the surfaces of serous membranes, and into the meshes of the areolar tissue, as well as poisons and other substances that are soluble and dissolved in that fluid.

If this be so, the difficulty just now mentioned vanishes. Of the two sets of absorbing vessels, the lymphatics and the veins, one set may continue to perform its functions, while the other fails to do so. This theory is quite consistent with the actual phenomena of dropsical disease; and whether it be altogether true or not, a part of it is certainly true; that, namely, which assigns to the veins a *large* share in the whole process of absorption. The experiments of Magendie and of others are quite conclusive upon that point.

It has also been fully established, that fluids may and do pass into or out of the veins, in the living body, (not by any vital process, but) by mere physical imbibition and transudation, through the coats of those vessels; that when the veins are distended to a certain degree, the entrance of additional fluid, through their sides, is impeded or prevented; that, when the distending pressure is still greater, the aqueous part of the blood may even pass in the other direction out of the vessel; and that, on the other hand, when the veins are comparatively empty, the surrounding serous fluid passes readily into them, or, in common language, is absorbed. The venous absorption is explicable therefore upon the principles of *endosmose* and *exosmose*, as laid down by Dutrochet; or I would rather say, according to the more general and more simple laws of *heterogeneous attraction*, as explained by the late Professor Daniell.

Imbibition, being a form of that attraction, belongs in various degrees to all the tissues of the body. Its rapidity—and even its direction in regard to the elastic coats of a vessel surrounded by fluid, and also carrying fluid of a certain consistence—will vary with the varying distension of the vessel. When the vessel is but moderately full, the exterior fluid passes uninterruptedly inwards, and is conveyed away by the internal current, and the rapidity of its entrance is proportional to the velocity of that current. When, on the other hand, the vessel is kept much distended by its contents, the contained fluid, or its thinner part, passes continually outwards; and there is an intermediate degree of distension, at which the pressure is just sufficient to prevent the transit of fluid in either direction. Magendie found, accordingly, in a well-conducted and conclusive series of experiments, that by regulating the conditions of comparative emptiness or fulness of the circulating system, he could accelerate, or retard, or suspend altogether, the operation of a poison dissolved in the humours of the body. In other words, he could thus accelerate, retard, or prevent, the process of absorption or imbibition through the blood-vessels.

Bearing these physiological truths in remembrance, we shall have no difficulty in showing that the chronic forms of dropsy are attributable partly, and chiefly, and in many instances entirely, to undue plenitude of the veins; and that this venous repletion is produced, almost always, by some impediment to the free return of the blood towards the heart.

When the connective tissue of a limited part of the body becomes filled and distended by a serous liquid, we call the swelling *œdema*; but this is exactly the same in its nature as anasarca. Now, œdema is often the consequence of some mechanical obstruction to the venous circulation. We can produce it whenever we will. Our countryman, Dr. Lower, nearly two hundred years ago, tied the jugular vein of a living dog. When a few hours had elapsed, he observed that all the parts beyond the ligature, reckoning from the heart, were much swollen: and upon dissecting the animal after death he found that the areolar tissue of the head and face was filled, not with red blood, as he had expected it might be, but with clear and limpid serum. On another occasion he placed a ligature upon the vena cava, just above the diaphragm: death soon ensued, and a large quantity of water was discovered in the cavity of the peritoneum, 'non aliter quam si ascite diu (canis) laborasset.'

These experiments were not instituted with any reference to the pathology of dropsy; yet that Lower perceived their bearing upon that subject is plain from this sentence: 'Quantum hæc ad ascitis et anasarcæ causas investigandas conducant, aliis judicandum relinquo.' He even explains the extravasation of the thinner or serous part of the blood as taking place by infiltration, 'velut in filtro,' through the pores of the vessels.

Precisely similar phenomena succeed the compression or obliteration of a large vein in various parts of the body. In operating for popliteal aneurism, Mr. Travers was obliged to tie the femoral vein; the connective tissue of the limb was speedily infiltered with serous fluid. Long-abiding œdema of one foot and ankle has been cured at once by the reduction of a crural hernia, which had been pressing for the same length of time upon the femoral vessels. You have heard, I have indeed already spoken, of the disease called *phlegmasia dolens*; a disease that is very common in women soon after childbirth, although it is not peculiar to them, nor to the female sex. The foot, leg, and thigh become enormously œdematous. The essence of this disorder is inflammation of the femoral vein; blocking up that vessel near the groin, and retarding or precluding the return of the venous blood from the limb. One arm often swells in the same way, and from a similar cause, in women who are afflicted with cancer of the breast. In pregnancy, the gravid uterus sometimes presses upon the iliac veins, and obstructs the current of blood within them: the consequence is, anasarca of the lower extremities, which disappears as soon as the pressure is removed by the delivery of the woman. The flow of blood through the vena portæ is frequently hindered, by disease in the liver, or by other causes; and serous liquid accumulates in the peritoneum, constituting ascites; and the fluid of ascites may itself so compress the large venous trunks within the abdomen, as to impede the return of the blood from the lower extremities, and thus render them anasarcous. A French physician, M. Tonnellé, narrates several cases in which serosity was found in the cavity of the arachnoid, in conjunction with obliteration of the venous sinuses of the dura mater. In all these instances we have retardation of the venous current, undue plenitude of the veins, and dropsy of the part from which they proceed. The natural exhalation goes on, and the exhaled fluid stagnates and collects, because the channel through which it should be drained away is choked up. The larger the vein, and the nearer we approach the heart, the more extensive is the dropsical accumulation: and if we could plant an obstacle at the very termination of the venous stream, we should dam up the blood in the whole system of veins, and produce a general dropsy.

Such an obstacle is frequently placed there by disease. The returning blood is checked at its entrance into the heart; at the confluence of all the veins of the body, where they unite to empty themselves into the right chambers of that organ: and then anasarca of the universal areolar tissue comes on, and water collects in all or most of the great serous cavities.

It is no part of my present purpose to enquire how such disease of the heart as is productive of dropsy arises. Commonly we find the right auricle and ventricle enlarged in capacity, the opening between them unnaturally wide, and the tricuspid valve unequal to its office of closing that aperture. Such a morbid state of the right heart may be occasioned by any cause which impedes the flow of blood *out* of its cavities. The diseased condition of those cavities may be primary; but it is oftener perhaps consecutive to other disease. It may be produced by disease of the lungs, preventing the right ventricle from freely delivering its contents into the pulmonary blood-vessels. Or the retarding cause may be still more distant, in the left side of the heart, keeping the pulmonary blood-vessels unduly full, and thereby hindering indirectly the passage of the blood from the right ventricle. The dropsy may ultimately depend, therefore, upon some bar to the circulation, placed even at the mouth of the aorta. Obstacles situated anywhere in the circuit formed by the right heart, the lungs, and the left heart, have the effect of producing secondary changes in the parts behind them. But disease, thus propagated in a direction retrograde to the course of the blood, is propagated gradually, and sometimes very slowly. These are points of much interest, which we shall investigate together by and by. I allude to them now, that you may not be perplexed by a knowledge of the fact, that diseases of the heart often exist for a long while without inducing dropsy. It is with disease of the right side of the heart, whether primary or secondary, that passive dropsy is especially associated.

As if to furnish the *experimentum crucis* in respect of this doctrine, disease does sometimes, with a curious precision, dam up one only of the two great venous trunks, at the junction of which the right auricle is placed: and then the dropsy is as curiously limited to that half of the body in which the tributary veins of the obstructed trunk originate. The first example of this which I ever saw was a most remarkable one. The patient was dropsical in his upper half only. His arms were so hugely anasarcous that he could not bring his elbows near his sides: his neck and face were hideously bloated and exaggerated, and his eyes prominent and staring; while his lower limbs were of their natural size, and appeared preposterously small, and out of proportion. The poor man looked as if the upper part of his body had been stuffed, for acting some ridiculous part upon the stage. The cause of this strange and distressful state was found to be the obliteration of the vena cava superior, close to the auricle. Its sides had been pressed together by a large aneurism of the aorta; and a portion of the vein was fairly sealed up. I have seen two or three similar cases since.

Objections have, however, been taken to the accuracy of the conclusions drawn from such cases as I have related; and it is fit that you should be aware of them. Thus it is stated that veins have been found obliterated, and yet there was no dropsy. Now to this objection it may be replied, in the first place, that it is not every vein, the obliteration of which would cause manifest œdema. It must be the principal venous trunk of the part concerned. When some of the secondary and smaller veins alone become impervious, the blood may reach, and return by, the primary branches with sufficient readiness to relieve the turgid capillaries, and prevent any serous accumulation.

But (it may be said) the principal vein itself has been found converted into a solid cord, and still there was no dropsy. Granted: but it does not follow that there never *had been* dropsy. You know that when a large artery is tied, the circulation is carried on in the corresponding limb, by means of collateral arterial branches: imperfectly indeed at first; but, at length, as the supplemental channels become more numerous and free, the supply of blood to the limb is as copious as ever. It is precisely the same, *mutatis mutandis*, with the veins; only that the anastomosing venous tubes are not (perhaps) so readily developed as the arterial. Now I am not aware of any instance in which it has been shown that the principal vein was obliterated, and yet there neither was, nor had been, any œdema of the limb. The recorded cases have been met with in dissecting rooms, and the previous history of the subject has been unknown or unregistered. Mr. Kiernan has told me that he once examined the body of woman who had excited much curiosity among the medical men by whom she had been seen during life, on account of a remarkable and enormous dilatation of the superficial veins of the abdomen. She was not dropsical, and the cause of the huge varix was sought for with great interest after her death. The inferior cava was obliterated. Here the compensating result was obvious to the sight; the new channels had answered their purpose, and performed the functions of the original channel. The history of this case was incomplete: it was not ascertained whether the woman had always been free from dropsy.

I hold this objection therefore to be invalid, until some authentic instance shall be brought forward of the obliteration of a large venous trunk, without a corresponding accumulation of serous fluid, either at the time when the observation is made, or at some previous period in the lifetime of that individual. It is, besides, possible enough, that the obstruction of a large vein may be effected gradually, by the slow encroachment, for instance, of a growing tumour; and the collateral circulation may begin to be enlarged with the first impediment in the vein, and may keep pace with and counterbalance that increasing impediment, till the closure of the vessel is complete: so that, from first to last, there may be no noticeable dropsy.

Again, it is affirmed, and truly affirmed, that anasarca often occurs, without any obliteration of veins, and independent of any discoverable organic disease in the heart, or anywhere else. We see this every day in weak chlorotic girls, with bloodless cheeks and pale lips. Some of you saw a case of this kind which was lately under my care in the hospital; besides the anasarca, the systolic sound of the heart was accompanied by a loud, unmistakeable bellows murmur. This girl got quite well, and left the hospital without heart murmur, or any other trace of disease. There could not then have been any organic change; in fact, there was not. Yet was there, virtually, a retardation of the venous circulation; not by any mechanical obstacle opposed to its course, but in consequence of the debility of that hollow muscle, the office of which is to propel onwards with a certain degree of force the blood that reaches it. Girls of this description have weak and flabby voluntary muscles; and it is reasonable to presume that the involuntary muscle, the heart, partakes of the general debility of the muscular system, and becomes incapable of sending the blood forwards with the requisite energy. Nay, I believe that a heart thus feeble may yield a little and dilate under the resisting pressure of the blood that enters its chambers; and so an occasional but temporary bellows sound may arise, from the altered relation between the cavities of the heart and their outlets. Certainly this view of the matter is strengthened by the evidence of the *juvantia* and the *lædentia*. If you are tempted, by the pain complained of by your patient, or by the violence with which her heart is throbbing, to take away blood, you find that she is ultimately made worse by the depletion; on the other hand, if you give her steel, feed her well, keep her bowels free, place her every morning under a cold shower-bath, and make her take daily exercise in open and pure air, you find that she recovers her lost strength, that colour returns to her lips and cheeks, that her palpitations cease, and her dropsy vanishes. In proportion as the muscular system in general receives fresh tone and vigour, does that particular muscle, the heart, also regain the degree of power necessary for the effectual discharge of its proper function, which is very much that of a forcing-pump. Such is the way in which I should explain both the cause of the dropsy, and the cause of its cessation. In such cases our patients do not simply *recover*; they are *cured*. I should apply a similar explanation to some other forms of dropsy. Andral describes a certain *cachectic* disposition of the body as being a cause of dropsy; persons may be bled into a dropsy, or starved or weakened into a dropsy. These are genuine instances of dropsy from debility, which is what the ancients conceived all dropsies to proceed from. The thin and watery quality of the blood induced by frequent bleedings, by insufficient nourishment, by certain poisons, or by other causes, may doubtless facilitate, or even determine, the passage of its aqueous part through the coats of the veins. But admitting this as a concurrent cause, I am disposed to the belief that all passive dropsies occurring under the circumstances just adverted to, and without any apparent organic disease or change, are mainly to be ascribed to debility of the heart: and viewed in this way they are all brought under the same general principle; viz., the retardation of the blood in the systemic veins.

A large class, then, of passive dropsies, depending upon mechanical congestion, and defective absorption by the veins, are traceable, in their origin, to the heart; and we call them, accordingly, *cardiac* dropsies. But another class, perhaps as numerous, are connected in a remarkable manner with certain diseased conditions of the kidneys; and these, for the sake of distinction, we style *renal* dropsies. I shall say a few words respecting them, after I have briefly considered the other source of dropsical swellings, adverted to in the commencement of this lecture; namely excessive *exhalation* of serous liquid. Dropsy so caused comes on suddenly and tumultuously, and is spoken of as being *acute* or *active.* It borders closely upon inflammation, and sometimes can scarcely be discriminated from inflammation with serous effusion. The condition of the capillary circulation is supposed to be intermediate between that in which the ordinary amount of exhalation is maintained, and that in which inflammatory effusion takes place. The excessive increase of exhalation is analogous to what we observe in other parts and predicaments of the body; to the abundant perspirations, for example, that are occasioned by violent exercise; to the plentiful flow of tears caused by any irritation of the eye, or by the passion of grief; to the augmented watery discharges from the mucous membrane of the bowels produced by purgative medicines; all of which may be independent of inflammation, but all of which are attended with congestion that might readily be pushed into inflammation. In point of fact, if the exhalations to which I have now referred were poured into closed cavities, instead of proceeding from surfaces that are situated on the exterior of the body, or that communicate readily with the exterior, they would *constitute* dropsies.

The phenomena of *active dropsy* are of this kind: a labourer is engaged in some employment, which, while it requires considerable bodily exertion, and causes copious perspiration, necessarily exposes him also to the influence of external cold and moisture: he has been digging (perhaps) in a wet ditch, in winter time, and he pauses to take his meal; or he has been unloading a waggon, and rides home, some miles, in a heavy rain that wets him to the skin; or he has been mowing, in the heat of the summer, and lies down to sleep upon the damp grass. All these suppositions are derived from actual occurrences. The perspiration is suddenly checked; and in the course of a few hours he becomes universally anasarcous. Again, a patient labouring under or just recovering from scarlet fever ventures out into a cold atmosphere, while the process of desquamation is yet going on; and he is attacked with dropsy of the connective tissue; and, it may be, of some of the larger cavities also. The urine at the same time is observed to be scanty, troubled, mixed with blood.

To comprehend this rapid change from a state of health to a state of dangerous disease, we must again have recourse to the findings of physiology.

Besides the constant exhalation which takes place from the inner faces of the shut serous cavities, a large amount of watery fluid is continually thrown out of the system, by all those surfaces that communicate with the air—by the skin, the lungs, the bowels, the kidneys. Now it is well ascertained that when the excretion of aqueous fluid from one such surface is checked, the exhalation from some other surface becomes more copious. It is probable that the aggregate quantity of water thus expelled from the system in a given time, cannot vary *much*, in either direction, without deranging the whole economy. But we are sure that the amount furnished by any excreting surface may vary and oscillate within certain limits consistent with health, provided that the defect or excess be compensated by an increase or diminution of the ordinary expenditure of watery liquid through some other channel. Sound health admits and requires this shifting and counterpoise of work between the organs destined to remove aqueous fluid from the body. This supplemental or compensating relation is more conspicuous in regard to some parts than to others. The reciprocal but inverse accommodation of function that subsists between the skin and the kidneys affords the strongest and the most familiar example. In the warm weather of summer, when the perspiration is abundant, the urine is proportionately concentrated and scanty. On the other hand, during winter, when the cutaneous transpiration is checked by the agency of external cold, the flow of dilute water from the kidneys is strikingly augmented. All this is well known to be compatible with the maintenance of the most perfect health. But supposing the exhalation from one of these surfaces to be much diminished, or to cease, without a corresponding increase of function in the related organ, or in any excreting organ communicating with the exterior, then dropsy, in some form or degree, is very apt to arise. The aqueous liquid thus detained in the blood-vessels, seeks, and at length finds, some unnatural and inward vent, and is poured forth into the areolar tissue, or into the cavities bounded by the serous membranes.

All this is more likely to happen when the elimination of some poison through the skin is going on, as I shall have occasion to show you by and bye.

Dropsy of one part sometimes supervenes suddenly upon the rapid disappearance of a watery collection from another part. It is no uncommon thing to see the swollen unwieldy legs and thighs of an anasarcous patient quickly unload themselves, and resume their natural bulk and symmetry. His friends congratulate him, and each other, that his disease is leaving him; but as his legs are emptying, he becomes drowsy, forgetful, comatose, apoplectic; and after his death we find the ventricles of his brain distended with serous fluid.

Or the dropsical accumulation may be transferred from its place through a safer channel. The best instance of this that occurs to my recollection I heard related by the late Dr. Farre. A gouty individual had hydrocele; dropsy of the tunica vaginalis. After the disease had lasted for some time he got very drunk one evening, with rack punch, which greatly disordered his alimentary canal, and brought on a kind of cholera. He had profuse vomiting and purging, which quite exhausted him; and at length he fell asleep. When he awoke in the morning he found that his hydrocele, which had been a large one, was gone: and it never returned. Such an accidental cure is most instructive.

If water be injected, in some quantity, into the blood-vessels of a living animal, the animal soon perishes; dying generally by coma, or by suffocation: and when the carcase is examined, the lungs are found to be charged with serous liquid, or water is discovered in the areolar tissue of some other part, or in the shut serous membranes. If, however, the animal be first bled, and then a quantity of water be injected equal to the quantity of blood abstracted, the injection is followed by no serious consequences.

Facts like these throw, as it seems to me, a strong light upon a confessedly obscure part of pathology. It appears that under various circumstances the blood-vessels may receive a considerable and unwonted accession of watery fluid, and that they are very prone to get rid of the redundance. When they empty themselves through some free surface, their preternatural distension is relieved by a flux. If, on the other hand, the surface be that of a shut sac, in discharging their superfluity they cause a dropsy. Why sometimes this organ, and sometimes that, is selected as the channel by which the superabundant water shall be thrown out of the vessels, we can seldom tell. We often find it difficult to determine which of the two facts in question is to be considered the antecedent, and which the consequent. For not only is it true that when the blood-vessels become overloaded with serous fluid, they readily sweat out a part of it, but also that when they are in the opposite condition of comparative emptiness, when they contain less blood than is natural, they are equally ready to replenish themselves by absorbing fluids from any source to which they can find access. In the case of the man who was cured of his hydrocele upon the occurrence of profuse watery discharges from his stomach and bowels, it seems clear that the expenditure of serous liquid from one part led to its absorption into the blood from another. When anasarca suddenly leaves the extremities, and fatal coma follows, it appears probable that the absorption is the first of the changes, and the effusion the second: and had this effusion been determined to the mucous membrane of the intestines, to the skin, or to the kidneys, it would have brought relief and safety to the patient, instead of causing his death.

We have obtained, then, a glimpse of one or two most important principles in regard to the pathology of dropsy. The blood-vessels, when preternaturally full of aqueous fluid, have a strong tendency to empty themselves; when preternaturally empty, they readily drink up watery fluid wherever they come into contact with it. From the discharge of their superfluity of water arises a dropsy, or a flux. The cause, and the cure, of many dropsies, lie in these propositions.

The application of these principles to the supposed case of active dropsy must be obvious. No doubt, in some such cases, actual inflammation takes place; but in many of them there is merely the dropsical effusion, without any other trace or evidence of inflammatory action. The two facts which it chiefly concerns us to remark are these—first, that the aqueous portion of the blood, which in health is habitually carried off to a very considerable amount by the skin, is suddenly diverted from that tissue; the perspiration, sensible and insensible, is suppressed: and secondly, that the areolar tissue, or the large serous bags, or both, become filled with serosity.

It is not by any necessity, however, that the vicarious excretion is turned upon these serous surfaces. In truth, the intercepted perspiration more often escapes, or labours to escape, from some free surface; and then we have, not a dropsy, but a flux. Diarrhœa, for example, is more common, under the supposed circumstances, than anasarca or ascites: apparently because there is a closer analogy of structure, and a more direct consent or agreement in function, and a stronger reciprocal influence, between the skin and the mucous membrane of the alimentary canal, than between the skin and the serous tissues.

Brief allusion has been made to a large class of chronic dropsies, connected with and dependent upon a particular renal disease. This important species of dropsy will require a detailed examination hereafter. It is more complex, and of more obscure pathology, perhaps, than *cardiac* dropsy. It certainly has a more direct relation also to what I have just been describing as active dropsy: of which it may almost be regarded as the chronic form. Sometimes the kidney disease, of which the dropsy is an incidental and not an essential symptom, springs up silently, and without obvious cause. Sometimes it may distinctly be traced back to its origin in an attack of acute dropsy: in which complaint the kidney always and manifestly labours, its functions being violently deranged, and the urine being small in quantity, and mixed with blood.

In this chronic and renal dropsy, the watery accumulation is accounted for by the deficient excretion through the customary channels. The blood-vessels deposit that excretion in a wrong place. The urine, in the outset of the dropsy at least, is scanty. The skin is almost always dry, harsh, and unperspiring. The anasarca usually increases or decreases, as the quantity of urine diminishes or augments. Remarkable alterations take place also in the qualities and composition of the urine itself: it has a low specific gravity, contains albumen, and is deficient in urea. The blood degenerates too; and other organs of the body, and especially the heart, are apt to fall into disease. The suppression of perspiration, and the appearance in the urine of blood or serum, unchanged by the secerning power of the kidney, form striking links of connection between acute and renal dropsy.

In the sketch that I have been endeavouring to give you of the pathology of dropsy, I have taken extreme cases to elucidate the two varieties of that disease which have been respectively denominated active and passive. Let me once more present to you, in a summary view, the points of resemblance, and the points of distinction between them.

They resemble each other in the result; namely in the collection of serous liquid in the circumscribed cavities and vacuities of the body. They differ in the rate at which the collection augments.

In the well-marked acute dropsies the liquid is rapidly effused, in quantity much beyond the natural amount of exhalation. In the well-marked passive dropsies the exhalation goes on as usual, but the fluid exhaled is not taken back again into the circulating vessels with sufficient facility. In one case the circulation is disturbed and tumultuous; in the other, it remains tranquil. Although all dropsical transudations probably take place through the walls of the capillary vessels, there would seem to be, in the more acute forms of dropsy, an increased flow of blood in the arterial channels; while in the completely chronic forms there is a defect of absorption by the veins. Active dropsies are sometimes spoken of as belonging to the left side of the heart, passive dropsies to the right.

But there are intermediate degrees, in which the full veins are not only unable to admit any addition of aqueous liquid, but also to retain that which they already hold; and serosity gradually exudes through their parietes.

What connects all these forms of dropsy is a preternatural fulness in some part, or the whole, of the hydraulic machine. And this seems to be the grand key to the entire pathology, as well as to the remedial management, of the disease.

I scarcely need point out to you the fact, that the water of dropsy is liable to change its place, in obedience to the force of gravity. In general anasarca, when the serous accumulation slowly augments, it first becomes visible about the feet and ankles. There are two causes for this; the one occasional in its operation, the other general. The veins of the lower extremities are apt, when the patient is erect, to be more turgid than other veins; for unless the action of their valves be quite perfect, those vessels sustain the weight of a large superincumbent column of blood, which concurs with other causes to retard the upward current, and to keep the depending capillaries unduly full. Under such circumstances, the effusion, or the arrest of absorption, may *take place* around the insteps earlier than in any other part. But in general it is not so. In most cases, the truer and simpler reason of the earlier manifestation of dropsical swelling about the ankles, is merely that the serous liquid which fails to be removed from the areolar tissue in all parts of the body, gravitates towards the *lowest* part; and being thus collected into a comparatively small space, is rendered more perceptible. During the night, when the horizontal posture is maintained for several hours, the œdema of the ankles disappears, but the neck and face, perhaps, become bloated and puffy. And it is obvious why, in these cases, the feet, towards evening, swell more than the hands. The hands receive the serous fluid from the areolar tissue of the arms alone; the feet, that which sinks down, not only from the legs and thighs, but from the head and trunk also. The limbs may be looked upon as bags, which fill up in proportion to the quantity of liquid detained. And the lungs are similarly bags: and in these cases we commonly may hear the crepitation of pulmonary œdema in their lowermost portions.

I mentioned an instance in which one-half only of the body was anasarcous, and that the upper half. The descent of the dropsical fluid was prevented by the dress of the patient; the waistband of his trousers having compressed the areolar tissue through which alone the gravitating liquid could seek a passage. So, sometimes, it is stopped at a lower point of its descent by tight garters, and the thighs swell earlier than the insteps. It is not at all uncommon to see persons who, in the daytime at least, and in the erect posture, are anasarcous in the lower half only of the body. We do not so often meet with anasarca of one moiety of the body, the division being made by an imaginary plane drawn through its axis. Yet this does occasionally happen. This curious phenemenon is usually the result of a mere accident, the anasarcous patient being unable to leave his bed, or to lie at all except on one side; and then the accumulating liquid gravitates to that side. I have, however, seen one case to which this explanation would not apply. I believe that some local obstruction to a large vein in the neighbourhood of the shoulder caused œdema there, and the fluid sank down and filled the areolar tissue of that side alone. Fortunately, I had no means of verifying the truth of this conjecture, for the man recovered.

Cæteris paribus, those parts of the body become the most loaded with serous fluid, and show the anasarca the plainest, of which the areolar tissue is plentiful and loose; as the eyelids, and the scrotum. But in extreme cases the liquid pervades the same tissue where it is much more dense and compact: as where, for example, it is subjacent to mucous membranes. In the examination of a dropsical corpse, the mucous coat of the intestines may sometimes be seen to be elevated by the water collected beneath it. It then looks like jelly, and the *valvulæ conniventes*, which are flat and thin in their ordinary state, become round and convex. Dropsy of the submucous tissue of the air-passages is frequently a cause of death.

Many persons seem disposed to ascribe these anasarcous swellings, especially when they make their appearance suddenly, to inflammation; and much is said about the frequency of *inflammatory dropsy*. But the facts we have just been considering sufficiently refute this theory. If the serous liquid be the product of inflammation, what is the part inflamed? It cannot be, as some appear to think, the stretched areolar tissue itself; for if so, the inflammation must shift its quarters under the influence of gravity. The term inflammatory dropsy may not perhaps be indefensible when applied to that class of dropsical affections that have been spoken of under the head of active dropsy. I am far from denying the frequent agency of inflammation in producing changes which, in their turn, lead to dropsy, but we shall do well not to confound those collections of serum mixed with blood or with coagulable lymph, which are distinctly events or products of inflammation, with other collections of serum which resemble the former simply as being such, but differ entirely from them in every other particular. To the class denominated active, which occur suddenly, from defect of some one or more of the usual channels of aqueous excretion, and which are usually attended with much disturbance of the whole system, the epithet *febrile* would not be inappropriate. There may be some few cases in which it is impossible to determine whether the effusion be inflammatory in its origin or not. If the serum be turbid, if we can discover in it the smallest admixture of pus, or of flakes of lymph, or if the disease have been marked by the ordinary signs of internal inflammation, we need not hesitate in our opinion. One of the latest systematic writers on dropsy in this country holds that all dropsies are more or less inflammatory. We can see one reason for this mistake (for a mistake it surely is) in the relief and amendment which often ensue upon the employment of blood-letting in dropsy.

The general *prognosis* in this disease may be readily gathered from what I have said of its causes and conditions. The anasarca which occurs in chlorotic young women is the least perilous, and the most curable. Of the rest, febrile dropsies are more obedient to treatment, and oftener admit of complete recovery, than the passive or chronic. Local dropsies are to be regarded with hope, in proportion as the obstruction on which they depend is capable of being removed, or of being compensated by the development of fresh channels for the delayed blood. As far as the mere water is concerned in the chronic forms of the disease, cardiac dropsies are more readily dispersed for a time, but more likely also to return, than dropsies which are complicated with renal disease. It is obvious also that the immediate danger of dropsical accumulations will depend much upon the place the liquid may occupy. The difference in this respect is immense between the tunica vaginalis, and the pericardium; between the areolar tissue of a limb, and that which lies beneath the mucous membrane of the glottis.

It remains that I should offer a very few final remarks concerning the principles upon which dropsies are to be treated.

The first object is to get rid of the preternatural accumulation of watery fluid: the second is to prevent its collecting again; in other words, to remedy the diseased conditions which gave rise to the dropsy. Indeed, if we can accomplish this second object without delay, the dropsy will generally disappear of its own accord. Now *venesection* will often sensibly reduce the dropsical swelling. In what has been called active or febrile anasarca, general blood-letting may act in several ways. It helps to relieve the congestion, akin to inflammation, upon which the effusion depends: it tends to abate the undue action of the heart: and by emptying the blood-vessels, it facilitates the re-absorption of the effused liquid, and its ultimate ejection from the system.

But although blood-letting is the most direct and certain way of unburdening the loaded veins, and therefore, in many instances, the most effectual remedy for the dropsy, it is by no means adapted to all, nor even to many, forms of the malady. It will always indeed remove a portion of the aqueous ingredient of the blood, but it expends at the same time its albumen and its red particles. It impoverishes the circulating fluid, and thus enfeebles the patient more than would the indirect measures, to be mentioned presently, for evacuating the collected liquid. Perhaps, by rendering the blood more watery, venesection may indirectly favour the transuding of its serum outwards whenever the venous current happens to be retarded. It certainly weakens the central organ of the circulation; and to muscular debility of the heart we have already seen that certain forms of general dropsy may owe their origin; and thus it is that ill-timed or excessive bleeding may be the *cause* of dropsy. In these forms of anasarca, instead of robbing the veins of their blood, we seek to repair the quality and richness of that fluid, and so to restore the deficient tone and vigour of all the muscles, and of the heart among the rest.

In most cases then it is inexpedient to let blood; and we endeavour to empty the vessels indirectly, and in such a manner as to withdraw from them the more watery parts only of their contents. In other words, it becomes our object to augment the discharge of watery fluid from one or more of the secreting surfaces of the body: but it must not be the inner surface of a shut sac.

I noticed before the close analogy that obtains between dropsies and fluxes. Dropsy is a flux into a closed cavity. Fluxes would be dropsies if the fluid poured forth did not leave the body. And you are to observe that we frequently try to cure a dropsy by producing a flux.

By what surface or channel this artificial drain shall be attempted, is often a matter of great nicety and importance. In some cases we strive to promote the discharge of the superabundant water by the way of the kidneys: in others by the mucous lining of the alimentary canal: in others by the external skin. The circumstances by which our choice must be determined will come under review hereafter.

Passive dropsies are much more difficult of cure than active, and will often baffle the best-directed efforts. You are not, however, to regard those passive dropsies which depend upon the obliteration of a large vein as necessarily incurable; for if a collateral venous circulation be accomplished, the dropsy will permanently disappear. But we must give nature the credit of the cure in such cases. Time is the best remedy; and sometimes all that we can do is to alleviate in the meanwhile the most distressing or threatening of the symptoms.

I mentioned, in the outset of the lecture, that the presence of the dropsical fluid may constitute nearly all the suffering of the patient, as well as much of his danger. Now, when we cannot get rid of the water by bleeding, or by internal remedies which excite serous discharges, we may often afford great present comfort to our patient, and prolong his days, by letting the water out by a slight mechanical operation. *Paracentesis* is the scientific, and *tapping* the vulgar name for this proceeding. It has been performed successfully, by means of a small trocar, to evacuate the water from the brain in chronic hydrocephalus; it is often resorted to for the purpose of emptying the peritoneal cavity, and the tunica vaginalis testis; and it is not seldom practised to let out the fluid of anasarca; for *acupuncture* of the legs and thighs and scrotum is only another form of tapping.

In the local variety of dropsy that is called *hydrocele*, the re-accumulation of the liquid is sometimes prevented by exciting just so much inflammation of the membrane as may cause its opposite surfaces to cohere; whereby the cavity itself being abolished, any return of the disease is rendered impossible.

This is an expedient which we scarcely dare to employ in other species of dropsy; in ascites, for example: first, because the inflammation itself would place the patient's existence in imminent peril; and secondly, because if it could be safely conducted, the adhesion and obliteration might seriously embarrass and impede the functions of important organs.

The circumstances which require and justify this mechanical remedy; the rules and precautions to be observed in its performance; and the measures to be adopted for preventing the recurrence of the accumulation, by the removal of its efficient cause, will all be considered in detail when we come to treat of the special forms of dropsy.

LECTURE XVI.

Diseases of the Brain and Nervous System. Difficulties of the subject. Short Review of some points in the Physiology of the Brain and Nerves. Peculiarity of the Cerebral Circulation. Pressure.

HAVING brought to an end the observations which it seemed expedient that I should lay before you respecting some prominent topics of general pathology, I next proceed to the consideration of individual diseases; and I shall take them up one by one, in that anatomical order to which I adverted in the introductory lecture of this course. That is to say, I shall go *a capite ad calcem*: interpolating those disorders which, although they have a name, have as yet no ascertained local habitation, wherever it may seem most convenient to introduce them. I mentioned before one advantage, as it seems to me, of bringing together, in juxta-position, all the diseased conditions to which the same part, or the same neighbourhood, of the body is liable—namely, the facility thus afforded of comparing the phenomena by which they are characterised, and of discriminating one disorder from another. In taking the parts in succession from the head downwards, we adopt a sort of order, definite enough for the purpose of aiding the memory, and yet free from the trammels which belong to all attempts at arranging diseases according to their essential nature and affinities.

I propose then to speak, in the first place, of the diseases of that portion of the body, which though it includes many distinct parts, is called, collectively, the head. I pass over the maladies to which the integuments of the head are liable, because they will fall more naturally and conveniently into the class of cutaneous disorders; and I come at once upon one of the most interesting, and at the same time most difficult and obscure subjects of special pathology—that which embraces the *diseases of the brain and nerves.* Though it will be a slight departure from the plan I have proposed of taking diseases as they affect different parts of the body from the head downwards in succession, I shall speak of the diseases of the spinal cord, and of the nervous system generally, in connection with those of the brain. To disunite them would neither be easy nor useful.

The study of the maladies and disordered conditions of the brain and nervous system, is beset with peculiar difficulties: and, accordingly, our knowledge of these diseases is less precise than of the diseases of most other parts of the body.

1. One source of difficulty lies in the fact, that the structure of the nervous system has no perceptible or understood subservience to its functions. This is especially true in respect of its most important parts. We do not discover in the mechanism of the brain that adaptation of means to an end which is so conspicuous in many other parts of the body: and consequently, though such adaptation doubtless exists, we are not able to trace the reason or the manner of its interruption. We find in the lungs an apparatus of tubes and cells fitted for the reception of air, upon the expansion of the chest by the contraction of certain muscles; of which muscles also we can see and understand the action. If we meet with any obstruction of those tubes, or any obvious impediment to the play of those muscles, we perceive at once how and why the function of respiration is deranged. So, too, both the machinery whereby the blood is moved and circulated, and any material check or obstacle that may happen to clog the working of that machinery, are plain and comprehensible. But no alterations that become visible, after death, in the brain or spinal marrow, afford us any such intelligible explanation of the interruption of *their* proper functions; which are, in three words, *sensation*, *thought*, and *motion*. An apoplectic cell has no relation, direct or inverse, that we are capable of appreciating, with a sentiment: nor a distended lateral ventricle with the faculty of memory. How the sound substance of the brain connects itself with the facts of mental consciousness, how the will impresses its mandates upon the nerves which transmit them, in what manner the brain-stuff can minister to a process of intellectual reasoning, we neither know nor are able to conceive. The morbid anatomy does not in any way or degree elucidate the disorder, simply because we fail to discern any relation or correspondence between the natural structure and the healthy office of the parts concerned.

2. It is a further source of difficulty, that physiologists have not yet been able to determine, with anything like completeness or certainty, what share the several parts of the brain and

spinal cord have in regulating, respectively, the functions which all physiologists acknowledge to belong to the nervous system in the aggregate. There are many and convincing reasons for believing that the brain is a complex organ; but we can seldom put our finger upon this or that portion of the nervous matter which composes it, and say *here* dwells the power that governs this or that particular function.

3. Again, the brain and cranio-spinal axis are so encased by their bony coverings, that, in the living body, we are unable to ascertain their physical conditions by means of any of our senses. Of many parts of the frame we discover the state by the sense of sight; and of many parts which we cannot see, we still may recognise the changes by the faculty of touch, or by the ear. The brain and spinal cord we can neither see, nor hear, nor handle.

4. Besides these obstacles to the acquisition of information, by the exercise of our own senses, concerning the organs affected, the very disturbance of the functions of his brain cuts us off, in many cases, from that kind of information which we might otherwise derive from the statements of the patient himself.

5. There is a still greater cause of perplexity, with which we have to contend. The very same symptoms accompany alterations of the brain apparently of a very different, nay of the most opposite kind: and on the other hand, changes of structure, which, so far as we can perceive, are absolutely identical in their nature, are associated, in different cases, with totally different symptoms: and more frequently than not, nervous diseases are attended with *no* alterations of structure, appreciable by our senses.

6. And lastly, we are perpetually asking ourselves, when we find the proper functions of the nervous system disordered—is this disorder the result of disease in the nervous matter itself? or is it merely sympathetic of disease in other parts? for there are few diseases of any kind which do not, in some degree, modify or disturb the due exercise of the offices of the brain and nerves: and it is very difficult often, and sometimes it is impossible, to determine whether, and how far, the disturbance is primary or secondary.

With all its difficulties, however, the pathology of the brain and nerves is always full of interest. How can it be otherwise, when we reflect that the nervous system is the medium through which we hold communion with the world around us; the stage upon which all the characters of animal life are represented; the instrument and expositor of the mind?

And with all its difficulties, there is also a good deal, in the pathology of the brain and nerves, that is fairly made out, and well understood; and at this present time there are, both here and abroad, many acute minds earnestly at work upon this intricate and mysterious subject; and we may well expect that much which is now obscure, will gradually reveal itself more clearly under their steady and enlightened researches.

I shall endeavour to point out to you what is *known* of the morbid conditions of the nervous system; I shall also state the conjectures and probabilities by which our judgment and practice must be guided, when absolute certainty is unattainable. With mere speculative questions, that have no practical bearing, I shall meddle as little as I can.

Our knowledge, I say, of the exact functions of the different parts of the nervous apparatus is scanty and imperfect. Some certainties, however, we possess: and some strong probabilities which almost amount to certainties. Without first expounding, briefly, my creed upon these matters, it would be impossible for me to explain, as it would be for you to understand, the notions I entertain respecting many of the diseases of the brain and nerves.

Passing by, for the present, what is called the *sympathetic* system, which consists of a chain of ganglia connected with each other, and with the cerebral and spinal nerves, by a ramifying network of nervous filaments, and which mainly sustains and regulates the *organic* life of the body—I am about to direct your attention to the great *nervous centres*, which, with the nerves that specially belong to them, govern for the most part its *animal* life.

The great nervous centres have been classed among themselves—not, indeed, with absolute strictness of boundary, but for convenience and aid in studying their special functions, relations, and disorders—in the following way, from below upwards.

1. The *spinal cord*, and (what with some terminal modification and added complexity of structure may be regarded as its prolongation, or rather as the junction-knot between it and the rest of the encephalon) the *medulla oblongata*. These, the spinal and the oblong marrow, compose the centre on which depend what are called *excito-motor* phenomena: that is, reflex-actions; many bodily movements which are involuntary; some move-

ments of which we are even unconscious, and what are called co-ordinate or adapted movements. It is, in itself, therefore, an independent centre of nervous power; but it is also a conductor of nervous force between the nerve trunks and the encephalic centres.

2. The ganglionic centres, or foci, of the nerves of the several senses, of smell, namely, of sight, of hearing, and of taste. They are collections of gray matter that lie between the decussation of the pyramids and the floor of the lateral ventricles. In this group, Dr. Carpenter has taught us to reckon the remarkable pairs of ganglionic bodies named the *corpora striata*, and *thalami optici*; the latter forming probably the chief foci of the nerves of touch or of common sensation, while the former, connected as they are with the motor tract of the crura cerebri, convey motor impulses in respondence to sensations excited through the thalami. Collectively this division constitutes or includes the *sensorium commune*; and is presumably the seat of consciousness, and contains the focus of emotional and of instinctive movements. It forms the centre appropriated to the phenomena called *sensori-motor*.

Taken together, the preceding two divisions are sometimes spoken of as the *cranio-spinal axis*.

3. The *cerebellum*; which, with its lobes, lies above the medulla oblongata, and of which the main function is supposed to be that of regulating and harmonising the various movements of the body. It is conjectured also that it may be the special seat of the *muscular sense*. Whatever exact knowledge, however, we possess of the purposes of the cerebellum, is chiefly negative. It certainly has no share in the functions belonging to the centre next to be named, the strictly cerebral functions; no share in the manifestation of intelligence, instinct or will. It certainly is not (as some have thought it), the sensorium commune. If it governs the involuntary movements of co-ordination, it is probably through the posterior columns of the spinal cord, which reach the cerebellum through the restiform bodies.

4. The *cerebrum*, or brain-proper, consisting of the two cerebral hemispheres. This greatly exceeds in magnitude, and overlaps, all the rest of the encephalon; crowning, as it were, and in a certain sense and degree dominating, the divisions below it. We regard this as the special and exclusive instrument of the intellect and of the will: the organ of thought; the seat of perception, of memory, of the reasoning power, and of ideation,

or the formation of ideas. It is called accordingly the centre of *ideo-motor* phenomena.

We may confidently adopt the common belief that the gray or vesicular, which are also much the more vascular portions of these nervous centres, are the parts in which their peculiar powers reside, arise, or operate; and that their white and fibrous portions are, like the white and fibrous nerves, mere conductors of the nervous influence.

This influence, which has thus its source in the gray matter, and is for the most part transmitted by the white, has some seeming affinity with electricity, and certain of its effects may be very exactly imitated, in animals recently dead, by galvanism. But that the two are not identical we know from this, among other conclusive facts, that it travels at a comparatively slow pace. Helmholtz has ascertained that its rate of motion is 112 feet in a second; a rate even less rapid than that of sound through the air.

The motive force resides in the spinal cord. The muscles furnish the instruments of motion, and are connected with the nervous centres by the nerves.

Now there is a certain class of muscles which contract without our willing their contraction; and generally without our being conscious that they are contracting. Such are the heart, the muscular fibres of the alimentary canal, and of the bladder. These are, therefore, called involuntary muscles; and are under the sole dominion of the sympathetic system.

There is another large class of muscles, which obey the bidding of the will, and serve the purposes of prehension, locomotion, and bodily effort. These are called, accordingly, voluntary muscles.

There is still another distinct set of muscles, of which the habitual action is involuntary, yet which submit also to the interposing control of the will. You will call to mind at once the muscles of respiration, which act while we are asleep, or otherwise unconscious; the muscles which close the eyes in winking; and the sphincters, which regulate the entrances and outlets of the body. Here, I say, the habit is involuntary, but the occasional action is prompted and governed by volition. But sometimes the involuntary action rebels against the willed action, and overcomes it. The muscle contracts in spite of the will.

Nay, those muscles which, ordinarily, move only in obedience to volition, do sometimes, under the influence of strong emotion, or of disease, contract independently of any effort of the will, and even in opposition to, and defiance of, the voluntary power.

Under certain circumstances the limbs move with much briskness and force in decapitated animals, in which sensation and volition are extinct. Some physiologists hold, indeed, that sensation and volition are properties of the spinal cord; and they would object to these cases, that no one is warranted in affirming the movements in question to be independent of the will. The animal has no means of informing us whether it feels or not, any more than the human head that has been severed by the axe or by the guillotine.

This point, however, has been settled by certain phenomena which are observed to occur, in the human body, under disease. Limbs completely palsied as to voluntary motion, and quite dead as to sensation, do yet, under certain conditions, contract and move when the integuments are pinched; the rational patient neither feeling the pinch, nor being conscious of the movements.

Whence does the impulse that leads to motion in these cases proceed—how is the motive power awakened?

The answer to this physiological question has a most important bearing upon the pathology of the nervous system.

It is no part of my purpose to enter into any history of the steps by which this curious problem has been worked out. Its solution is an achievement of our own time; and I may add, of our own country. The foundation of our present knowledge of the properties of the spinal cord was laid by my former colleague at the Middlesex Hospital, Sir Charles Bell, whose discovery of the differing functions exercised by the two distinct roots of the spinal nerves, has justly rendered his name immortal in the annals of physiology. I profess no more than to sketch, in mere outline, the leading facts that have been ascertained; yet I must, in passing, pay the tribute due to another indefatigable labourer in this department of science, whose sagacity enabled him to seize the clue, and in great measure to unfold the mazes, of the labyrinth in which this part of the physiology of the nervous system was so long entangled. Dim and uncertain glimmerings of the truth appear in the writings of bygone authors, but it was never clearly discerned, and plainly stated, and successfully applied to the elucidation of a large class of disorders, until the publication, in 1832 or 1833, of Dr. Marshall Hall's ingenious and most interesting researches into 'the functions of the medulla oblongata and spinal cord.' Similar views appear to have suggested themselves, about the same time, to Professor Müller of Berlin. I must recommend you to study the works of these authors; and I may also point out, as fit writings for your perusal, Dr. Grainger's 'Observations on the Structure and Functions of the Spinal Cord;' Dr. Carpenter's two works, 'Principles of General and Comparative Physiology,' and 'Principles of Human Physiology;' and a very able paper on the Pathology of the Spinal Cord, by Dr. William Budd, in the 22nd volume of the 'Medico-Chirurgical Transactions.' More recently, the whole subject has been thoroughly investigated, and our knowledge of it greatly extended and corrected by Dr. Brown Sequard. Most important contributions also to this perplexed and interesting branch of medical science have been made by Mr. Lockhart Clarke.

If, on the other hand, you wish to see how nearly the idea, which has been so happily simplified into an intelligible principle by Dr. Hall, was reached by earlier observers, you may consult the writings of Dr. Whytt, upon nervous diseases.

What, then, respecting this intricate subject, are the main facts and doctrines which modern research has made clearer?

It seems ascertained that the movements of many of those muscles which acknowledge the empire of the will, depend essentially upon some momentary molecular change in the condition of the spinal cord. This change (whatever may be its nature) is capable of being effected in three several ways.

First, volition, or emotion, originating in the encephalon, may send forth an influence, which travels rapidly to the spinal cord: whence, the requisite change having been instantly produced. the motive influence passes, with proportional speed, along the nerves which connect the cord with the muscles to be moved.

Secondly, the change productive of motion may be wrought in the cord, whether the brain be attached to it or not, by mechanical, chemical, or electrical agencies, operating directly upon the cord itself.

Thirdly, the change productive of motion may be wrought in the cord, by an influence carried to the cord, not from the brain, but from the extremities of nerves distributed upon the internal and external surfaces of the body.

The action of this nervous circle, whereby, I say, an influence is first carried from the surfaces of the body, along nerves to the spinal cord—whence again a responsive influence is transmitted, or *reflected*, as it were, to certain muscles along certain other nerves—has been called by Dr. Hall the *reflex function* of the spinal cord. The apparatus subservient to this function is named by him the *excito-motor system*; the nerves which carry the impression *to* the cord are *incident* or *excitor* nerves; those which convey the motive impulse *from* the cord, *reflex* or *motor* nerves. Dr. Carpenter's terms (which I like better, except for their similarity in sound) are *afferent* and *efferent* nerves.

Whether, as Mr. Grainger taught, there are four sets of fibres, which anatomy can exhibit, belonging to the nerves and the great nervous centres, namely, *sensiferous* and *volition* fibres, connected with the gray matter of the sensorium and of the cerebrum respectively, and ministering to the faculty of feeling and to the will; and *incident* and *reflex* fibres connected with the gray matter of the cord, and belonging to the excito-motor system: whether this be so, or whether the efferent fibres be the same, while the afferent fibres are different; the latter coming to the spinal marrow both from the encephalon and from the various surfaces, just as two trains may arrive at Euston Square ultimately by the same rail, although the one starts at Derby and the other at Birmingham; or (which is perhaps the better illustration) just as, in some houses, the same bell is made to ring in the servants' hall, by pulling, indifferently, the dining-room or the drawing-room rope:—which of these two hypotheses is the more correct, I am not competent to determine.

This reflex action, independent of the will, and although attended often by consciousness and sensation, yet often also exercised when there is neither, governs the orifices by which air and food are introduced, and excrements are voided. The infant breathes and sucks by it; the adult uses his will for bringing nutriment into his mouth; in both, the act of deglutition, after the food has reached a certain point, is involuntary. The expulsion of the fæces, the urine, the semen, and the fœtus, is regulated by the same function. Nevertheless, most of these muscular acts are capable of being moderated and directed by volition. The reflex power, on the other hand, extends, both in health and in disease, to the entire system of the strictly voluntary muscles; during health it is manifested only in the maintenance of what is called their *tone*, their natural tension and firmness: in disease, as we shall hereafter see, it sometimes acts upon them with terrific energy.

Some of the difficulties which I enumerated in the beginning of the lecture, as impeding our researches into the diseases of the nervous centres, are insurmountable. One or two of them, however, appear to call for a more attentive consideration.

I say we often fail to discover, even when helped by the microscope, *any* deviation from the natural condition of these nervous centres, or of their appendages; although the disorder of their functions may have been broadly displayed.

We are not to infer, from this, that no change has taken place in these parts. The only legitimate conclusion is, that the nervous functions are liable to be deranged, impaired, or suspended, by altered conditions, not traceable by our senses, or at least not yet detected by us, of the organs which minister to those functions.

There may be only one such undiscovered disturbing cause, variable in degree in different cases; or (what is more probable) there may be several such conditions differing in kind. A blow or fall, which *jars* the brain; a strong mental emotion; an electric shock; a tea-spoonful of prussic-acid: any one of these causes may suddenly destroy life, yet leave no vestige of its action in the nervous substance upon which it operates. It is probable that the fatal condition is not, in each case, the same.

We may even form a reasonable conjecture of the manner in which the invisible changes are sometimes brought about. We can conceive, for example, that *undue pressure* upon the nervous pulp on the one hand, or *insufficient pressure* on the other, may constitute conditions of the kind we are in search of; and I shall be able, I think, to convince you that such is sometimes the case. Again, we can conceive that such conditions may be furnished by the varying state of the cerebral circulation. In point of fact, we *know* of some changes in the circulation through the brain which have the effect, invariably, first of modifying, and at length, if they are continued, of arresting, the cerebral functions. If *no* blood be sent through the brain (whether from failure of the heart's action, or from undue contraction of the minute cerebral arteries—a condition which I shall dwell more upon hereafter), consciousness soon ceases; and the same result ensues if *unaërated* blood circulate in the cerebral vessels.

But whatever may be the nature of the unknown, and perhaps fugitive, physical conditions of the nervous centres, thus capable of disturbing or abolishing their functions, it is useful to keep in our minds a distinct and clear conception of the fact that there must be some such physical conditions. By steadily retaining this idea of their real existence, we may hope, at length, to get some insight into their nature; which we are the less likely to obtain, if we dwell only on the obvious and visible injuries effected in the nervous substance; associated, as they are apt to be, with so perplexing a diversity of symptoms. Indeed, by the help of this distinct conception, we are at once enabled to reconcile some of the seeming anomalies and inconsistencies to which I before adverted. The same symptoms, I repeat, have been found to accompany physical lesions of the nervous centres, apparently different in kind, place, and degree: and, on the contrary, physical lesions, apparently identical in their nature, extent, and situation, are attended by different and contradictory symptoms. We must not attribute the symptoms, in such cases, to the visible physical lesions, but to some unperceived condition of the nervous centres concomitant with those lesions. The *proximate cause* of the *symptoms* escapes our notice. The obvious physical changes may be remoter causes of the symptoms—causes of this proximate cause: but they may also be merely contemporaneous effects of some other remote agency.

I have adverted to deviations from the natural and healthy circulation of the blood through the brain, as being capable of modifying the nervous functions. Of such deviation one mode which is conceivable, and which has been assigned as a presumed cause of morbid phenomena, is a variation in the relative quantity of blood contained respectively in the arteries and veins that lie within the cranium. And it seems probable enough, that a healthy condition of the cerebral circulation, may imply and require a certain balancing and adjustment of the amount of blood carried in these two sets of vessels. But with this theory —that disturbance of the functions of the brain may result from an altered ratio of the arterial and venous blood therein—has been associated another; namely, that although the blood may, at different times, be variously distributed between the cerebral veins and arteries, yet the absolute quantity of blood circulating within the cranium, is always and necessarily the same, or nearly so.

This notion, broached by the second Monro of Edinburgh, and upheld (as it then seemed) by experiments performed upon animals by Dr. Kellie, received at a later period the sanction and approval of Dr. Abercrombie. And, resting upon such authority, I had been in the habit of delivering the same theory, not, however, without some misgiving as to its soundness, in these lectures. It has been completely overthrown by Dr. Burrows.

The doctrine was this. The brain is closely shut up in an unyielding case of bone. Its surface must therefore be exempt from the influence of atmospheric pressure. Hence, supposing its substance to be unaltered and incompressible, it would seem impossible to empty the blood-vessels of the brain. The cavity being completely full, the blood which circulates in those vessels can neither be materially increased, unless something is displaced or compressed to make room for the addition; nor materially diminished, without the entrance of something to supply the place of the blood subtracted.

Dr. Kellie noticed that while, in animals bled to death, the other organs of their body were emptied of their blood, and blanched—the brain presented its ordinary appearance, and even seemed to contain more blood in its superficial vessels than usual. Having satisfied himself upon this point, he varied his experiment. He first made a small opening in the skull, by means of the trephining instrument, taking away a little circular piece of bone, and *then* he bled the animals until they died; and in these cases he found that the brain was as completely drained of red blood as the rest of the body. He did that with respect to the cranium which house-keepers do when they tap a barrel of beer. You know that if the barrel be quite full, you may introduce a fawcet at its lower orifice, but no beer will run out through it. The pressure of the atmosphere operates upon that portion only of the fluid which is now exposed to the air, and its effect is to keep the beer in. But if you bore a small hole with a gimlet through the top of the cask, and so admit air to the upper surface of the beer, it will then flow readily through the lower outlet. Dr. Kellie imitated this process of making a *vent-hole*, when he trepanned the skulls of sheep, and admitted air to the yielding membranes of the brain.

He availed himself also, in these researches, of what he considered the converse experiment. He desired to ascertain whether, under circumstances calculated to gorge the vessels of the *head*, those of the *brain* were or were not made really more full than usual. With this object he examined the brains of two men who had been hanged. When the scalp in these cases was divided, a great quantity of blood escaped; marking plainly enough the congestion of the vessels *exterior to the cranium*: but there was no such congestion observable *within.* 'The sinuses contained blood, but in no extraordinary quantity; the larger vessels on the surface and between the convolutions were but moderately filled; and the pia mater was, upon the whole, *paler,* and less vascular, than we often find it in ordinary cases.' Similar appearances have been noticed by myself. I paid particular attention to the condition of the head, during the examination, below-stairs, of the body of Bishop, the murderer of the Italian boy. When the corpse was brought hither after the execution, the eyes were bloodshotten, and the lips and countenance turgid and livid. The inner surface of the scalp when it was turned back, and the exposed surface of the skull, were very red and bloody; and in one part, on the right side of the head, there was some blood *extravasated.* But when the bone had been sawn through, and the skull-cap removed, the large veins of the brain did *not* appear unnaturally full.

In the year 1826 I was present in St. Bartholomew's Hospital, at the opening of the head of a woman who had been hanged the day before, for murder. I find the following statement in a note which I made at the time. 'The scalp was bloody, but the brain was of very natural texture and appearance, and not more than commonly full of blood.'

Among the propositions deduced by Dr. Kellie from his observations and experiments, were the following :—

1. That in the brains of animals that have died of hæmorrhage, there is no lack of blood, but, on the contrary, very often a state of venous congestion.

2. That congestion of the cerebral vessels is not met with in those cases in which we should most expect to find it; in persons, for example, who die strangled.

3. That the quantity of blood in the cerebral vessels is not affected by gravitation: in other words, that it remains the same, whatever may be the posture of the body, and the position of the head.

Dr. Burrows, distrusting the whole theory, and unsatisfied with the experiments by which it was fortified, determined to repeat them, taking care, as much as possible, to exclude every conceivable source of fallacy: and he has shown, most convincingly, that Dr. Kellie's conclusions were erroneous.

First, he demonstrated that hæmorrhage *has* a most decided effect in depleting the cerebral blood-vessels, and in reducing the quantity of blood within, as well as upon the outside of the cranium. Two well-grown rabbits were killed; the one (A) by opening the jugular vein and carotid artery on one side of the throat; the other (B) by strangulation. Round the throat of the first, as soon as it was dead, a ligature was tightly drawn, to prevent any further escape of blood from the vessels of the head.

'The contrast between the two brains in point of vascularity, both on the surface and in the interior, was most striking. In the one scarcely the trace of a blood-vessel could be seen; in the other, every vessel was turgid with blood.'

He next investigated the effect of posture upon the condition of the intracranial vessels.

'Two full-grown rabbits were killed by prussic acid; and while their hearts were still pulsating, the one (C) was suspended by the ears, the other (D) by the hind legs. They were left suspended for twenty-four hours; and before they were taken down for examination, a tight ligature was placed round the throat of each rabbit, to prevent, as effectually as was possible, any further flow of blood to or from the head, after they were removed from their respective positions.'

'In the rabbit (C), the whole of the external parts of the head, the ears, the eyeballs, &c., were pallid and flaccid; the muscles of the scalp and bones of the cranium were also remarkably exsanguine. Upon opening the cranium, the membranes and substance of the brain were pallid, the sinuses and other vessels were exsanguine—anæmic beyond my expectation.'

'In the rabbit (D), the external parts of the head, the ears, eyeballs, &c., were turgid, livid, and congested. The muscles and bones of the cranium were of a dark hue, and gorged with blood, which at some parts appeared extravasated. Upon opening the cranium, the membranes and vessels were dark and turgid with liquid blood; the superficial veins were prominent, the longitudinal and lateral sinuses were gorged with dark blood, and there was staining of the tissues, if not extravasation of blood into the membranes. The substance of the brain was uniformly dark, and congested to a remarkable extent.'

From these experiments, Dr. Burrows draws the logical inference, that 'the principle of the subsidence of fluids after death operates on the parts contained within the cranium, as well as upon those situated in the thorax or abdomen.'

And of that absence of vascularity sometimes observed within the skulls of persons who have died of strangulation, he offers a very satisfactory explanation.

In the first place, the cerebral vessels *are*, in some instances, highly congested. Something will depend upon the position of the rope; which may press unequally upon the jugular veins on the opposite sides of the neck, leaving one of them more or less pervious.

'But there is another still more efficient cause of the occasional absence of congestion of the cerebral vessels after death by hanging. It is the subsidence of the *fluid* blood after death, while the body is yet suspended, through the cervical vessels which are not completely obliterated by the pressure of the cord. And, it should be recollected, there are some channels which are scarcely, if at all, affected by the compression of the rope. These other channels are the vertebral sinuses, and special plexus of veins, so ably delineated by M. Breschet.'

Moreover, the manner in which the corpse is generally examined, proves an additional source of fallacy. All the great vessels of the neck are usually cut across, and the viscera of the thorax removed from the body, before the skull is opened. Then, while the head is raised, during the operation of taking off the calvarium, and examining the brain, the blood, still fluid (as it almost always remains after sudden death of any kind), 'gravitates from the cranium, and pours from the divided cervical vessels into the chest.'

In further confirmation of Dr. Burrows' conclusions, I will read to you from the 'British and Foreign Medico-Chirurgical Review' for April, 1855, a short account of a very curious and conclusive experiment made by Dr. W. Berlin, under the direction of Professor Donders, of Utrecht:—

'A portion of the skull of a rabbit was removed, the corresponding piece of dura mater cut out, an accurately-fitting portion of a watch-glass let into the opening in the calvarium, and the juncture made air-tight with gum. Whenever, by compressing the nose and mouth, respiration was intercepted, within ten seconds increased redness of the pia mater could be seen with the naked eye. This condition was made still more evident by the use of the microscope: and each time some minutes elapsed before the congestion again diminished. A depending position of the head also increased the hyperæmia. Rapid abstraction of blood very distinctly diminished the diameter of the vessels.'

By this refutation of a prevalent error, not unlikely to warp or mislead our practice in some cerebral disorders, Dr. Burrows has done the science of medicine an essential service.

The theory which he has demolished involved probably more than one erroneous assumption. Dr. Burrows thinks that the anatomical structure of the human cranium does not warrant the opinion that its contents are withdrawn from the pressure of the atmosphere. 'The numerous fissures, and foramina, for the transmission of vessels and nerves through the bones of the cranium, appear to me (he says) to do away with the idea of the cranium being a perfect sphere, like a glass globe, to which it has been compared by some writers. If there were not always an equilibrium of pressure on the parts within and without the cranium, very serious consequences would arise at the various foramina of the skull.'

We fall back, therefore, upon another principle, whereby some of the difficulty and obscureness which attend certain affections of the brain and nerves may be explained. I mean the principle of *varying pressure* upon the nervous substance. Physiologists say that the cerebral matter is incompressible. This is another of the questionable assumptions implied in the foregoing theory. Upon what grounds the opinion may rest, I am ignorant: but whether the brain be compressible or not,—whether, that is, it be or be not reducible by pressure into a smaller compass, it is clearly capable of having different degrees of pressure applied to it, and of being pressed out of its ordinary form. We shall see, hereafter, that by pressure exercised from within, by the distension of what are called the ventricles of the brain, the convolutions on its surface are sometimes flattened, and the natural furrows between them nearly effaced. Pressure there certainly is in what I shall have to describe to you as *hypertrophy* of the brain. There must be considerable pressure on the nervous pulp when blood is poured forth within it from a ruptured artery, in cerebral hæmorrhage. But the phenomena noticeable when a portion of the skull has been removed by the trephine, show very clearly that the encephalon sustains pressure from varying states of the circulation during perfect health. The surface of the brain, seen through the circular opening in the bone, is observed to pulsate: and to pulsate with a twofold motion. With every systole of the heart, the surface protrudes a little; and it again subsides with the succeeding diastole. This shows that the tension of the arteries, produced by every contraction of the ventricles of the heart, exerts a degree of pressure upon the contents of the cranium. But the brain has also an alternate movement, corresponding with the movements of the thorax in breathing; rising with every act of expiration, and sinking with every act of inspiration. Now, during expiration, the blood escapes less freely from the head through the veins; and thus again vascular fulness is found connected with evidence of pressure on the parts within the head. In further proof of this, if any were needed, I might again refer to Dr. Kellie's experiments. He removed a portion of the cranium of a dog by the trephine. The brain was observed to rise and fall alternately, but so as always to fill the cranium; the rise being marked by a sort of protrusion through the hole that had been made. One of the carotid arteries was now opened, and in a minute or two afterwards there was an evident gradual sinking and receding of the brain from the margin of the bone. So likewise, when the blood was flowing from the rabbit (A) in Dr. Burrows' experiment, 'the conjunctiva was observed to become pallid, and the *eyeballs to shrink within the sockets.*'

It is certain then that, whether the cerebral pulp yields or not, there is a constant alternation of a greater and a less compressing force, exerted upon it during life. It is not improbable that this continual variation of the compressing force may be essential to the performance of the cerebral functions. May not the brain be thus incessantly *charged*, if indeed it be (as has been suggested by no less a philosopher than Sir John Herschel) a sort of 'electric pile, constantly in action,' discharging itself by the nerves, at brief intervals, 'when the tension of the electricity developed reaches a certain point'? However this may be, it is equally certain that the compressing force may transgress its natural limits, in either direction; may be too great or too little. The functions of the nervous centres may be perverted, or lost, when the pressure becomes excessive; or, on the other hand, when the pressure is insufficient.

It is plain that excess of pressure may cause fatal coma, or defect of pressure fatal syncope, and yet no evidence of the operation of these causes be left in the dead brain. And we may explain, by the help of this same theory of pressure, a very singular phenomenon observed in certain forms of cerebral disease; I mean the *occasional* recurrence only of the symptoms, although the organic disease itself be *permanent.* For example, we see continually persons who are epileptic: that is, they have fits of convulsion and stupor *now and then*, and appear perfectly well in the intervals. After the death of such patients we sometimes find organic disease of the brain; a piece of bone perhaps projecting from the cranium, or a tumour, or a cyst: and this we are apt to consider as a sufficient explanation of the preceding disease; but we are always pressed with this difficulty: if the tumour or piece of bone were the cause of the paroxysms, why had the paroxysms any cessation?

It seems probable, or not improbable, that in such cases as these, and in many others, the permanent morbid condition is a predisposing cause only of the occasional symptoms; rendering the diseased organ more sensible to variations in the circulation; to accidental circumstances which determine an undue amount of compressing force, or a deficient amount: and I think Dr. Abercrombie has gone too far when he says 'we may safely assert that the brain is not compressible by any such force as can be conveyed to it from the heart through the carotid and vertebral arteries.'

Dr. Kellie narrates the following curious circumstance:— 'Mr. G., with a numerous train of distressing symptoms, which too well marked the existence of enlargement of the heart, and the violent propulsive energy of that viscus, had only one, characteristic of any disturbance within the head. On looking upwards to the whitened ceiling of a room, he saw a darkened spectrum, which vanished and reappeared with great regularity. It was soon discovered that the appearance of this umbra was synchronous with the systole of the heart, so that he used often, in my presence, to count his pulse with the utmost precision, by keeping his eye fixed on the ceiling, and numbering every appearance of the spectrum.' In this case it is presumable that by each contraction of the left ventricle of the heart, plethora of the cerebral blood-vessels was produced, and therefore an excess of pressure upon the cerebral substance. In that which I am about to quote it seems probable, on the other hand, that comparative emptiness of the vessels of the brain, and a consequent defect of the requisite degree of pressure, occasioned the morbid phenomenon.

A gentleman, thirty years old, was reduced to a state of extreme weakness and emaciation by some complaint of his stomach. As the debility advanced, he became very deaf; and this symptom varied in the following instructive manner. He was very deaf while sitting erect or standing; but when he lay horizontally, with his head quite low, he could hear very well. If, when standing, he stooped forwards so as to produce flushing of the face, his hearing was perfect; and upon raising himself again into the erect posture, he continued to hear distinctly as long as the flushing continued: as this went off the deafness returned. (ABERCROMBIE.) An old clergyman, who was formerly my patient, was troubled by two grievances: deafness and an intermitting pulse. They were both always benefitted by quina.

Objections, I should tell you, have been raised against this theory of pressure affecting the functions of the nervous centres: but I think the objections are susceptible of a satisfactory answer. I must content myself, however, for the present, with having pointed out the main grounds upon which the theory rests. The difficulties that attend it, and the considerations which diminish the force of those difficulties, will come necessarily before us on a future occasion.

LECTURE XVII.

Symptoms of Cerebral Diseases. Inflammation of the Dura Mater and Arachnoid, from external injury; from Disease of the Bones of the Ear, and of the Nose; from the poison of Syphilis.—Inflammation of the Pia Mater.

The functions of the brain, summarily expressed, being sensation, thought, and voluntary motion, we naturally look for disturbances of those functions whenever the organ suffers disorder or disease. And experience has made us familiar with various forms of disturbance to which these same cerebral functions are liable. Let us pass them shortly in review.

1. The faculty of *sensation* may be morbidly keen, or morbidly obtuse; or it may be perverted: in other words, it may deviate in degree, or in kind, from the healthy standard.

The sensations referred to the several surfaces and structures of the body, and to the organs of sense, may (without any fault in those parts and organs) be preternaturally acute. Tenderness ascribed to different parts, their natural sensations being heightened into pain; a general state of irritability; intolerance of light, and of noise; are so many instances of this over-sensitiveness of the sentient organ.

Under the head of diminished or defective sensation may be ranked, numbness in all its degrees, up to total loss of sensibility, or *anæsthesia*; dulness of hearing, deafness; dimness of sight, blindness; failure, or absolute extinction of the senses of taste, and of smell.

Perverted sensations, sensations unnatural in kind, or unprompted by their special exciters, are very numerous. To mention a few: giddiness; nausea; ringing sounds in the ears; ocular spectra; ill smells in the nostrils; false tastes on the palate; itching; and sundry uneasy feelings, many of which are indescribable; and some not even capable of being localised, such as general uncomfortableness. Various kinds of pain belong to this class; spirits violently high; causeless depression, anxiety, and dread.

2. Innumerable degrees and varieties of disturbance of the faculty of *thought* are met with. Delirium in all its shades; dulness and confusion of intellect; sundry defects of memory;

incapacity of judgment; and every degree of stupor up to complete coma.

3. Of the function of *voluntary motion* there are also various kinds and gradations of derangement: twitchings of the muscles; tremors of the limbs; rigidity from spasm; irregular and involuntary jactitation; convulsions; muscular debility; palsy.

Now, as I stated before, there is, and there can be no physical exploration of the living brain. We are limited, therefore, in studying its diseases, to the rational symptoms. It becomes our task to interpret the import of the multiform disturbances of function just enumerated, in every case in which more or fewer of them appear; and when you are told that these symptoms are apt to present themselves in almost every conceivable order and combination, and, moreover, that many of them may be sympathetic of diseases of other parts than the brain, you will scarcely need to be further informed, that the language they speak is often very hard to construe; that we frequently fail to reach and discover, by these outward signals, the inward things they denote.

I am about to consider, in the first place, some of the *inflammatory* affections of the brain, and some which may easily be mistaken for inflammatory affections; and I warn you beforehand, that, in respect of exactness of diagnosis, we are sadly barren of certainties in these matters. Hints, sketches, approximations, are nearly all that I can promise concerning not a few of the many diseased conditions to which the brain and its appendages are obnoxious.

In the brain, as in other composite organs, inflammation may be general or partial. It may attack certain tissues only: it may be seated in the substance of the cerebral mass; or in the membranes that envelope it.

I need not tell any of you that the membranes which invest the brain are three in number; the fibrous dura mater, the serous arachnoid, and the pia mater, which is composed of blood-vessels held together by a web of connective tissue.

Speaking generally, inflammation of the cerebral substance alone, is perhaps more common than inflammation of the investing membranes alone. The central parts of the nervous mass may and do suffer inflammation, while the membranes escape. But it seems to me scarcely possible that inflammation of the pia mater should take place without implicating also the surface of the convolutions with which it has so close a relation, and a vascular connection so intimate.

Again, with respect to the membranes themselves, the dura mater may be inflamed while the pia mater remains unaffected. I believe also that the arachnoid may suffer inflammation, and leave the subjacent pia mater untouched. Whether the arachnoid ever escapes participating in the inflammation of the dura mater on the one side, or of the pia mater on the other, is to be doubted.

Can we separate and distinguish these several inflammations by assigning to each its proper external phenomena? Seldom; scarcely ever. Doubtless each has its peculiar symptoms; and if inflammation were often strictly limited to the one membrane or to the other, and if the course and events of the inflammation did not modify the condition of the brain itself, by causing variations of pressure, or by affecting the circulation of blood through it, then we might expect greater uniformity, and might hope by careful and repeated observation to seize upon the desired distinctions. But this simplicity is not presented by the inflammatory affections of the parts within the cranium. Inflammation commencing in one membrane is apt to spread readily and rapidly to the rest, and to the cerebral substance; and the complication of diseased conditions coexisting within the skull at the same time, throws confusion over the whole subject. This uncertainty of exact diagnosis is however of the less consequence, inasmuch as when we have learned that inflammation is going on in any part of the encephalon, we have generally learned enough to direct us as to the main plan of treatment to be adopted.

After all, certain symptoms do present themselves more frequently when one part is inflamed, and certain other symptoms more frequently when another part is inflamed; and it will be proper and convenient to contemplate certain forms of meningeal inflammation separately.

Let us first, then, consider inflammation as it is confined, occasionally, to the *dura mater*—or to the dura mater and arachnoid.

This very rarely happens as an idiopathic or spontaneous disease; but it is not at all uncommon as a result of external injury. And we may advantageously trace its ordinary phenomena and consequences, by attending to these instances of traumatic inflammation of the dura mater. They were excellently well described, many years ago, by Mr. Pott. A man receives a blow on the head; the blow stuns him perhaps at the time, but he presently recovers himself, and for a certain period remains apparently in perfect health. But after some days he begins to complain; he has pain of the head, is restless, cannot sleep, has a frequent and hard pulse, a hot and dry skin, his countenance becomes flushed, his eyes are red and ferretty; rigors, nausea, and vomiting supervene; and, towards the end, delirium, convulsions, rigidity, or coma. Meanwhile the part which was struck becomes puffy, tumid, and somewhat tender; and if this tumid portion of the scalp be cut through, the pericranium beneath it is found to be separated from the bone; moreover, the bone itself is observed to be altered in colour, whiter and drier than the healthy bone; and if a piece of this bone be removed, it is also seen that the dura mater on the other side of it is detached from the cranium, and sometimes smeared with lymph or puriform matter. This is a form of disease very often met with by the surgeon. I have watched, with much interest, several such cases under the care of my hospital colleagues. One or two of them I will briefly describe.

In the year 1833, during Christmas time, the coachman of a lady living in my neighbourhood fell, being intoxicated, into a cellar or area, struck in his fall one side of his head, and tore up the scalp over a considerable space. He was carried to the hospital, where the loose flap of integuments was cleansed and replaced. After some days erysipelas came on, and then a much larger portion of the scalp sloughed away, so that the bone was laid bare to a frightful extent, and looked, at a little distance, as he sat up in bed, like the tonsure of a monk. Nevertheless the man seemed wonderfully free from suffering or distress: his pulse, indeed, was frequent, but it was said to be so during health. His intellect was clear, and he had *no* head symptoms; or rather no brain symptoms.

In the early part of February, 1834, he had a shivering fit, which was followed by convulsions of the right side of the body, and subsequently by paralysis of the right arm and leg, and by stupor, from which he could easily be roused. He would put out his tongue when desired to do so; but to every question he answered 'yes.' A portion of the left parietal bone was evidently dead. Here the trephine was applied; and a piece of bone being removed, the dura mater was exposed. It looked as if it also had lost its vitality. Some pus lay upon it. No relief followed the operation.

On the 10th of February fluctuation was detected beneath the dura mater, which was then slit open. About three drachms of puriform fluid escaped. The patient died soon afterwards, having had no active delirium throughout.

The surface of the dura mater was found to be nearly of its natural appearance, except where the trepanning had been performed. At that spot it was dry and sloughy. Over the whole of the anterior and lateral surface of the left hemisphere there lay, upon the arachnoid, a thick coating of coagulable lymph, smeared with pus: this extended down the posterior part of the hemisphere also, nearly to its base. There was no other morbid appearance; no fluid in the pia mater, nor in the ventricles. The substance of the brain was everywhere perfectly sound and healthy: it was divided in all directions in search of an abscess, but nothing unnatural could be detected.

Another man came to the hospital to have a small incised wound of the scalp looked at. The injury appeared to be trivial; the cut was dressed, and the man made an out-patient. A few days afterwards he came again, incompletely paralytic on one side of his body. I saw this man's skull trepanned; he was perfectly calm and collected: that part of the dura mater which corresponded to the wound was found to be inflamed: and there was pus diffused over the arachnoid covering the cerebral convolutions on the same side. He sank quietly into a state of coma, and so died. Not the slightest incoherence or delirium had been manifested, there had been no convulsions, nor was there any other morbid appearance within the cranium.

I mention these cases to show you the grounds of my own opinion that inflammation, beginning in the fibrous membrane, *may* affect the arachnoid, without *necessarily* extending to the pia mater; just as inflammation *may* overspread the pleura, or the pericardium, without touching the lung or heart which those serous membranes respectively clothe. Here no sensible traces of inflammation were discovered, deeper than the free surface of the arachnoid; and there had been no disturbance, till towards the end, of the proper functions of the brain. I conclude that the disease did not pass beyond the serous membrane; for I can scarcely conceive inflammation of the pia mater to exist without involving, in some degree, the surface of the brain: nor inflammation of the surface of the brain to exist without some manifest derangement of the cerebral functions. In the instances that I have been relating, the final stupor and palsy may reasonably be ascribed to *pressure* resulting from the *events* of the inflammation of the arachnoid; from the effused pus and lymph.

Inflammation of the dura mater is very rare as a simple and idiopathic affection. Dr. Abercrombie relates one instance of it, as the only one he had seen; and even that was not a pure case of inflammation of the dura mater. There was pus upon that membrane, which adhered to the cranium over a space as big as a crown-piece, and at that spot was ulcerated. But there was also found an adventitious membrane *beneath the arachnoid* where it covers the brain.

Speaking generally, this complaint is marked by pain of the head, by fever, and by rigors which intermit; and so regular sometimes are the intermissions, that the practitioner may be tempted to believe that he has got an aguish patient, and to administer bark. The intellectual faculties, especially at the outset of the disease, are but little affected; which is just what we might expect. The dura mater and the arachnoid lying apart from the surface of the cerebrum, their inflammation can have no other than an indirect influence upon its functions.

Although inflammation of the dura mater is very uncommon as an idiopathic or primary disorder, we very frequently meet with it as a secondary affection; and then there are few diseases more surely fatal, or less within the reach of remedies. It is as a consequence of what is called *otitis*, that physicians are chiefly accustomed to encounter inflammation of the dura mater. It results from disease of the internal ear, and of the petrous portion of the temporal bone. Sometimes acute inflammation arises within the tympanum, when there has been no previous disease: the patient has severe head-ache, and ear-ache; at length a gush of matter comes from the external meatus, but the pain does not, as it usually does in such cases, cease; it continues, or even increases in intensity: the patient begins to shiver; he becomes dull and drowsy; slight delirium perhaps occurs; and by degrees he sinks into stupor. In some instances no pus issues externally. More commonly symptoms of the same kind supervene upon a *chronic* discharge of purulent matter from the ear. It is scarcely possible to sketch an accurate general picture of this insidious, but most dangerous complaint. Next to seeing and watching actual cases of it, the best way of becoming acquainted with its phenomena is by attending to recorded instances. I will bring before you, therefore, some examples of inflammation of the dura mater, occurring in connection with disease of the interior of the organ of hearing.

A youth, sixteen years old, applied to the late Dr. Powell (who has related the case in the fifth volume of the 'Transactions of the College of Physicians') on account of an eruption, with an acrid discharge, behind the right ear. He had become deaf five years before, after scarlet fever, but no discharge took place at that time from the ear. In the following year, however, he had the measles, and then an abscess formed in the right ear; and after giving him much pain it burst. He had again suffered, three days before Dr. Powell first saw him, a sudden attack of very severe pain in the same ear. The pain quite deprived him of rest: but he had no fever, nor delirium, nor coma. He slept, indeed, a great deal, but that was the effect of opiates, which he took to relieve the pain. This symptom was quieted by the opium; but it always returned with severity if the medicine were suspended. A fœtid discharge came from the ear. On the tenth day of this attack, after a most violent paroxysm of pain, his strength rapidly declined, and he died.

'When the head was examined, the structure of the dura mater was healthy and natural, but beneath this membrane the whole superior surface of the right hemisphere was covered with a layer of coagulable lymph and pus. The vessels of the substance of the brain were not more numerous or loaded than usual, and the brain itself was healthy in every part. In the base of the skull the dura mater adhered to the bone, except at one part, of about half an inch diameter, just over the petrous portion of the temporal bone, where it was black and sloughy. The subjacent portion of the bone itself was carious, black, and crumbling; and contained fœtid pus.'

In this case, you will observe, there was no symptom to mark the extensive mischief within the head, except the *pain*: the pulse never exceeded 72; the skin was warm and moist; there was neither fever, nor delirium, nor convulsions, nor coma.

A girl, aged nine, (I take this case from Dr. Abercrombie, whose volume on the diseases of the brain is full of practically instructive *examples*,) had been liable to attacks of suppuration of the ear, which were usually preceded by severe pain, and some fever. She suffered one of these attacks in the left ear, in July, 1810. Upon the discharge of matter from the ear she did not obtain ease, as she had done on former occasions; but continued to be affected with pain, which extended over the forehead. When Dr. Abercrombie saw her, he found that, besides the pain, she had some vomiting, and impatience of light. Her look was oppressed; the pulse 84. Blood-letting, purging, blistering, and mercury, were employed without relief. Two days afterwards there was slight and transient delirium, a degree of stupor, and slight convulsions. She lay constantly with both her hands pressed upon her forehead, and moaning from pain, of which there had not been the least alleviation. On the fifth day from the commencement of the discharge, she continued sensible, and died suddenly in the afternoon, without either squinting, blindness, or coma, the pulse having been always under 90. A considerable quantity of colourless fluid was found in the ventricles of the brain, which, in other respects, was healthy. In the left lobe of the *cerebellum* there was an abscess of considerable extent, containing purulent matter of intolerable fœtor. The dura mater, where it covered this part of the cerebellum, was thickened and spongy, and the bone corresponding to this portion was soft, and slightly carious on its inner surface; but there was no communication with the cavity of the ear.

Here again pain was the most prominent symptom, and probably resulted from the partial inflammation of the dura mater. It is interesting to mark these two points:—that the disease in the bone imparted disease to the dura mater, although no passage was opened from the tympanum; and that this inflammatory state of the external membrane of the brain led (apparently) to deep-seated suppuration in the cerebellum; the parts lying between the abscess and the dura mater escaping.

This last, which may strike you as a strange circumstance, was owing (so at least I conjecture), to the extension of the inflammation from the suppurating ear to some of the veins of the skull; and the consequent formation in the cerebellum of one of those secondary abscesses so commonly noticed in uncircumscribed phlebitis. Two very remarkable instances of diffused inflammation of veins, and of its terrible effects, occurring in connection with purulent otorrhœa, have fallen under my own observation: one of them in private practice, the other in the hospital. As I am not aware that such consequences as supervened in these cases upon otitis, have received much attention, I will briefly describe them.

The first of these two patients was a boy, eleven years old, whom I attended with Dr. MacIntyre and Mr. Arnott. He had had a discharge of offensive purulent matter from the ear since the time when, four years before, he had gone through scarlet fever. In August 1833, he went, for a walk, into Kensington Gardens, and there lay down, and slept upon the damp grass. The next day he was attacked with headache, shivering, and fever. Strong rigors, followed by heat and perspiration, occurred very regularly for two or three days in succession; suggesting the suspicion that his complaint might be ague: but then pain and swelling of some of the joints came on, and were, at first, thought to be rheumatic. However, the true and alarming nature of the case soon became apparent. Abscesses formed in and about the affected joints; and one of the fluctuating swellings was opened, and a considerable quantity of foul, grumous, dark-coloured matter let out. After about a fortnight the child sank under the continued irritation of the disease. The hip-joint presented a frightful specimen of disorganisation; it was full of unhealthy sanious pus, the ligamentum teres was destroyed, the articular cartilages were gone, and matter had burrowed extensively among the surrounding muscles. The knee and ankle joints of the same limb were in a similar state. It is curious that the destructive disease of the joints was limited to those of the right lower extremity, while the primary suppuration was in the left ear. Unfortunately the head was not examined; but that the fatal disorder had penetrated from the ear to the dura mater, I entertain no doubt: in all probability the inflammation had involved the veins or sinuses of the head.

The second case had many points of similarity with this.

William Marriott, aged 19, was admitted under my care into the Middlesex Hospital on October 18, 1834, having pain and swelling of the right shoulder, wrist, and foot, with redness of the latter. He complained also of headache, vertigo, drowsiness, and of an occasional feeling of stupor. His skin was hot and dry, his face flushed, his tongue furred, his pulse frequent, (112), and his bowels were relaxed. A puriform discharge came from his right ear.

He had been suddenly seized, a week before, with sharp pain in that ear, which lasted twenty-four hours, when the discharge commenced and the pain was relieved. He then began also to have headache, which had never left him, and to be sometimes dizzy. Three days previously to his admission the rheumatism (as he supposed it to be) was first noticed in the foot. When this part was examined, the redness was found to be circumscribed, somewhat livid, and limited to the great toe. It had much the appearance of gout.

He soon began to be troubled with shivering fits, which recurred regularly every morning about the same hour, and were followed by burning heat of the skin, but no sweating. An abscess formed near the toe, and was opened by Mr. Mayo, and some healthy-looking pus evacuated. Next, a large fluctuating tumour near the shoulder was punctured, and three ounces of pus, mixed with blood, came out. After this incision the rigors ceased; but the abscesses continued open, and the discharge had an offensive smell. On November 14 it was discovered that matter had collected in the left hip: this also was emptied by puncture. On December 1, a very large quantity, not less than three pints, of unhealthy and grumous pus, was let out from a vast abscess which had formed in the loins: and pus was noticed in his stools. The discharge from the shoulder came at last to resemble the lees of port wine.

During all this while the patient remained feverish, with a dry parched tongue, and a rapid and feeble pulse. The diarrhœa continued, more or less, throughout. For some time before his death, which happened about the middle of the month of December, the left leg and thigh had been much enlarged by œdema.

I was not able to be present at the inspection of the body; and I have to regret that in the report which I received of it, the condition of the brain, of its membranes, and of its veins, was not noted.

The right shoulder-joint was extensively diseased; the cartilages were destroyed by ulceration over a considerable space. Those of the left hip were entire, but the synovial cavity was full of foul matter. The joint of the great toe was implicated also in the abscess which had formed there. The femoral vein, on the left side, was plugged up, throughout its whole extent, by a coagulum, which was firm and of a reddish brown colour at the upper part of the vessel, loose and darker towards the ham. The saphena was pervious; the iliac was free from disease.

The lungs had undergone partial disorganisation. Several distinct portions of the pulmonary tissue were nearly solid, while the tissue immediately around them was crepitant and healthy. From these small solidified portions, purulent matter could be made to ooze by gentle pressure.

The mastoid cells of the right temporal bone were filled with pus, and there was a slit-like opening in the membrana tympani. The small bones of the ear were sound.

I much lament that in these instances, the direct link of connection between the disease of the ear and the disorganisation of the joints was not demonstrated: for seeing (they say) is believing. Yet the pain in the ear, the discharge of pus from the external meatus, the subsequent pain in the head, coming on with fever and rigors, and followed after a short interval by destructive suppuration in several distant parts, and, in the last case, the actual femoral phlebitis; these circumstances form a chain of presumptive evidence, amounting, in my judgment, to moral certainty, that the fatal mischief, in each case, found entrance through 'the porches of the ear;' and that the dura mater underwent inflammation. The same evidence is scarcely less affirmative of the complication of cerebral phlebitis. Perhaps the veins of the diploë, which in the cranial bones are of considerable magnitude, were involved in the inflammatory mischief; perhaps the large sinuses of the brain. The close vicinity of the lateral sinus to the diseased bone, and its formation by a duplicature of the dura mater, would seem to render such a complication highly probable.

These views, which were brought forward in my first course of Lectures here, in 1836, have been confirmed by the publication more recently (1841), in the 'Medical Gazette,' by Dr. Bruce of Liverpool, of two cases witnessed by himself, of 'Phlebitis of the cerebral sinuses as a result of purulent otorrhœa.' He refers to several other instances of the same kind recorded by different authors. This combination of disease is doubtless more common than had been heretofore supposed: and the important pathological considerations connected with it will probably receive further illustration, now that the attention of the profession has been called to the subject by Dr. Bruce's paper.

Dr. Griffin has published, in the 'Dublin Journal of Science,' two examples of otitis attended with symptoms exactly resembling those of intermittent fever. One of them is as follows:—A young man, previously healthy, was attacked with fits of shivering, accompanied by pain in the left side of the head. At first the paroxysms were rather irregular, but they soon assumed the form of *tertian ague*; coming on every other day, at about the same hour; the cold fit commencing at noon, and lasting about half an hour, followed by a hot stage, of somewhat longer duration, and then a profuse sweat. In the intermissions the pain in the head was trifling: there was no thirst, nor heat of skin, but he did not sleep. A tumour formed over the mastoid process on the left side, and was opened, and a quantity of extremely offensive brownish pus sprang out with great force. This gave much relief. The bone was carious over a space as big as a shilling. After about ten days, the pain in the head and in the mastoid process became very severe; the patient had violent shivering fits many times in the day, great thirst, heat of skin, vomiting and delirium; his face was flushed, and his pulse hard; and he died within a few hours after the accession of these last symptoms.

The most remarkable features in this case were the similarity of the fits of shivering to the paroxysms of ague, their regular recurrence at periods of forty-eight hours, and the circumstance that they seemed to be checked, for some time, by the treatment proper in ague; namely, the administration of bark. The occurrence of *quotidian* paroxysms of the same kind has been noticed in relating some of the previous cases.

I have related them to show you what different symptoms may result from inflammation of the dura mater; and to put you upon your guard against overlooking the cause from which such inflammation does frequently originate. The suppuration of the tympanum, and consequent disease of the bone, are more common in scrofulous persons than in others; and they are more apt to occur as a sequel of scarlet fever than in any other way. I conceive that the inflammation which affects the throat in that disorder, and which often constitutes all its danger, creeps along the eustachian tube into the interior of the ear. In strumous subjects the fire thus lighted smoulders on, or if it ever go out, is readily rekindled; that part of the temporal bone, in which the organ of hearing is principally lodged, becomes carious; the membrana tympani is perforated; the little bones of the ear come away; more or less deafness ensues; and from time to time, or habitually it may be, there is a discharge of pus from the external orifice. At length the inner surface of the bone participates in the disease; and then the inflammation is apt to be propagated to the dura mater, or to the lateral sinus, in the manner of which I have given you some instances. It is in the first onset of the inflammation in the ear that remedies are most likely to be efficient in preventing this catastrophe. Leeches applied early and repeatedly to the mastoid process, especially when that part becomes tender, as it often does in such cases, and counter-irritation afterwards, are the best means in our possession. If symptoms of acute inflammation within the head supervene, the complaint may demand more active treatment, which I shall describe when I have spoken of inflammation of the other membranes of the brain. After what has been said, it is unnecessary to point out to you that the prognosis in these cases is very unfavourable. But we are not to abandon them in despair. That inflammation of the dura mater may be recovered from, we know, by what happens in certain injuries of the head: and the following would seem to be an instance of recovery when the source of the mischief was situated within the ear. A young lady, after the usual symptoms in the head, lay for three or four days in a state of perfect coma, and her condition was thought utterly hopeless. Her medical attendants continued to visit her as a matter of form; and one day they were agreeably surprised to find her sitting up, and free from complaint: a copious discharge of matter had taken place from the ear, with immediate relief: and she *continued* in good health.—(ABERCROMBIE.) We cannot be sure in such a case that the matter came from the brain; but the symptoms made that supposition exceedingly probable. The case shows clearly one of two things; either that pus may thus escape from the skull, and the patient get well; or that pus shut up in the cavity of the tympanum, or in the mastoid cells, may produce the urgent symptoms that are known to result from cerebral pressure.*

Cases are recorded of analogous disease communicated from the carious *æthmoid* bone to the dura mater; the patients having had pain in the forehead and purulent discharge from the nose, and becoming at last forgetful and delirious, and dying in a state of coma. I have never met with an instance of this kind; nor of inflammation spreading inwards from the socket of the eye: but I make no doubt that each may occasionally happen.

That part of the dura mater which is reflected over the inside of the skull may be regarded as its internal periosteum. Like the periosteum of the tibia, of the clavicles, of the bones composing the sternum, like the pericranium itself, this membrane is liable to a specific inflammation, one of the secondary effects of the poison of syphilis. In this form of disease you will often find the outer surface of the cranium painful, tender, knobby, embossed with smooth, round projections of considerable size: and there is good ground for believing that, under similar circumstances of contamination, similar prominences may arise from its inner surface also. There may be nodes on either side of these bones; within no less than without: or coagulable lymph may be effused and deposited within. And the internal nodes, or the effused lymph, by the pressure, or by the irritation which they cause, may give rise to cerebral symptoms: to pain in the head, convulsions, even, it may be, to paralysis or coma. Whenever such symptoms present themselves, you must not allow this possible mode of their production to escape your attention and enquiry. This care is the more important because for periostitis of syphilitic origin—if not for every form of periostitis—we possess a specific remedy in the iodide of potassium. To have discovered this curious and valuable truth should suffice to immortalise the name of the late Dr. Robert Williams. The effect of the iodide in these cases, when given in appropriate doses, is marvellously prompt and sure. The nodes cease to be painful, and begin at once to recede until they disappear. In the year 1852 I was consulted by an officer, who had returned 'invalided' from the Cape of Good Hope, where he had seen hard service in the field during the Kaffir war. From the preceding September he had been suffering epileptic fits, which were becoming more and more frequent, and for which I prescribed with very poor success. He complained also of increasing headaches on the right side; and at length I detected tenderness on pressure, unevenness of the skull, and slight redness of the surface, over the right temporal bone. These symptoms he was himself disposed to regard as remote consequences of a severe blow received several months before from a pistol that hung dangling in the doorway of his tent. Upon this discovery I forthwith prescribed the iodide of potassium, which was rapidly increased in dose from 3 to 5, to 10, and ultimately to 15 grains three times a day. The pain and swelling of the temple began at once to abate, and gradually vanished altogether; and he had no further attack of epilepsy.

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* This interesting subject—the connection between affections of the ear and disease in the brain or its membranes—has since been clearly and completely set forth by Mr. Toynbee, in a series of Clinical Lectures, first published in the 'Medical Times and Gazette,' for 1855.

I mention this case the rather—first, because it is somewhat imperfectly told in Dr. Todd's 'Clinical Lectures,' as it was related to him by the late Dr. Kennion of Harrogate. The patient, however, after his return to England, was under my exclusive care throughout. Secondly, to show you the extent to which the iodide may safely be given; at least in cases uncomplicated with renal disease. My patient had lost his epilepsy when, with my consent, he went to Harrogate. He again presented himself to me on his return, on October 23, in perfect health, and considerably heavier than when he left

London. To my surprise I found that, misapprehending my wishes, he had continued to take 15 grains of the iodide thrice daily from July 18, a period of more than three months. I have never, indeed, seen any of those ill consequences from full, but not excessive, doses of this substance, which have been apprehended by some physicians of eminence. The remedy should always be continued for some time after the external nodes have departed, or the symptoms produced by the presumed internal mischief have ceased, and it should then be gradually withdrawn.

These four then—*idiopathic* inflammation of the dura mater—very rare; inflammation of the dura mater by extension of disease from the æthmoid bone, or from the orbit—also infrequent; inflammation of the dura mater by extension of disease from the petrous portion of the temporal bone—very common; and syphilitic inflammation of the dura mater—also common enough: these four constitute the forms of inflammation of the outermost tunic of the brain which the physician may be called upon to treat. The inflammation is not always—nay, perhaps it is seldom, if ever—restricted to that tunic; but it begins there; and the essence of the disease is inflammation of the *dura mater.*

Acute *arachnitis*—by which I mean active and *uncombined* inflammation of the arachnoid membrane—is, I apprehend, a very uncommon disorder; although that term is of frequent occurrence in medical writings. I have shown you already that inflammation may pass from the fibrous dura mater to the serous membrane reflected over it; and thence (by what is sometimes called contiguous sympathy) to the opposite portion of the same membrane spread over the surface of the brain. So, likewise, inflammation may extend from the pia mater to the arachnoid. If simple arachnitis, of an acute kind, ever happen, it has not been my fortune to see or to recognise it; and I can tell you nothing about it. In truth, the authors who use the word arachnitis do not intend thereby to express unmixed inflammation of the arachnoid; but include under that term inflammation of the pia mater also. Some apply the name *meningitis* to that compound affection; and the only objection to this nomenclature is, that the dura mater is as much one of the meninges of the brain as either of the two others.

In the few remarks which I have to make upon *inflammation of the pia mater* (or, if you will, of the pia mater and arachnoid at once), I shall chiefly follow Dr. Abercrombie: because his observations are comparatively recent, and carefully made; because his veracity, and sobriety of judgment, and philosophical turn of mind, are well known; and because his cases (as regards this particular affection) are quite to the point, and his descriptions clear and concise.

But I must premise a word or two respecting the anatomical characters of the disease.

When the upper part of the skull, and the dura mater, have been removed, you may frequently see, on the surface of the exposed brain, what seems to be a thin layer of clear gelatinous substance: but this appearance is fallacious. Puncture here and there the transparent arachnoid, and a limpid fluid, like water, trickles out; and the jelly-like investment of the convolutions is gone. Now this thin serous liquid, thus collected in the meshes of the pia mater, may be the event of inflammation of that membrane: but it may also be produced, and it very often indeed is produced, by simple congestion and remora in the cerebral veins. Nay, a certain amount of serosity, in this situation, belongs to the condition of health. We cannot, therefore, with any certainty, infer, merely from seeing this serous effusion, that there has been inflammation: we judge of its import, by noting the co-existence, or the absence, of other traces of inflammation; and by the character of the symptoms that preceded death.

On the other hand, we may be sure that there has been inflammation of one or both of these tunics of the brain when we find *false membranes* between them; layers, *i. e.*, of coagulable lymph. In the effusion of this substance I conclude that the vessels of the pia mater play the main part; both because it is always, in such cases, excessively vascular, while the arachnoid is seldom found to be so in any remarkable degree, if at all; and also, because the false membrane commonly, though not always, sends down layers between those duplicatures of the pia mater which descend into the sulci formed by the convolutions: whither, as you know, the arachnoid does not go. In fact, considering the arachnoid as the serous membrane of the brain, we should expect that, when inflamed, it would present the events or products of inflammation on its free surface; and we sometimes find them there; but this is very rare; and for my own part, I look upon those effusions which lie beneath the arachnoid, between it and the pia mater, as being furnished exclusively by the vessels of which the latter membrane is mainly composed.

Now, the inflammation of these membranes (taking them together) commences and declares itself, by no fixed or uniform symptoms. The most common and striking phenomenon is a sudden and long-continued paroxysm of *general convulsions.* Sometimes this is the first thing noticed. Sometimes it comes on after a few days of discomfort, slight headache, and vomiting. The convulsions recur, and at length end in coma. Sometimes, again, the first attack of convulsions is preceded by violent pain in the head, setting in quite suddenly, and attended with screaming. Considering, on the one hand, the intimate connection between the pia mater and the gray matter of the convolutions, and, on the other, the presumed functions of that gray matter, we might expect that inflammation of the pia mater would soon be attended with some manifest derangement of the mental faculties. Accordingly, *delirium,* often violent and continued, is stated by most authors to accompany and denote inflammation of the membranes; and especially of the membranes where they invest the upper surface of the cerebral hemispheres. Yet I do not find that symptom mentioned in any of the various examples of meningitis recorded by Dr. Abercrombie. He does give cases, indeed, in which there *was much* delirium: but they were not cases of meningitis of any kind. He relates them as instances 'of a very dangerous modification of the disease, which shows only increased vascularity.' I venture with great humility to question or criticise any opinion of Dr. Abercrombie's: but I entertain no doubt about the nature of the cases which he so describes; and I hope to convince you by-and-by that they are not examples of inflammation at all. They neither show the anatomical characters of inflammation, nor yield to the remedies of inflammation. Excluding these cases, I do not find delirium specified as a symptom of uncombined meningitis. I shall abridge one or two of his well-marked examples of the disease.

A girl, aged nine, woke suddenly in the middle of the night, screaming from violent headache, and exclaiming that some person had given her a blow on the head. For the next two days she complained of some, but not much pain in her forehead, and did not even remain constantly in bed: no alarm was felt about her. On the third day she was seized with violent and long-continued convulsions, and immediately after the convulsions she fell into a state of deep coma: she remained in this state, with a natural pulse, till she died on the sixth day of the disease.

When the dura mater had been removed, the other membranes appeared highly vascular, except where this appearance was concealed by a layer of yellow adventitious membrane, spread out betwixt the arachnoid and the pia mater. This was distributed in irregular patches over various parts of the surface of the brain, but was most abundant on the upper part of the right hemisphere. It was as thick as a wafer, and in some places dipped down between the convolutions. A considerable quantity of it extended over the surface of the cerebellum also.

A child two years old was suddenly attacked one morning with severe and long-continued convulsions. The convulsions recurred many times; in the intervals she was dull and torpid, in a state of partial coma, with occasional starting, and a frequent and feeble pulse. On the fourth day she sank.

The surface of the brain, when the dura mater was removed, was covered in many places, betwixt the arachnoid and pia mater, by an adventitious membrane. It was chiefly found above the openings between the convolutions, and in some places appeared to descend a little way between them. The arachnoid when detached seemed to be healthy; but the pia mater was in the highest state of vascularity throughout; and when the brain was cut vertically, the spaces between the convolutions were most strikingly marked by a bright line of vivid redness, produced by the inflamed membrane. There was no effusion into the ventricles, and no other morbid appearance.

In another example, the whole surface of the brain was covered by a continued stratum of yellow false membrane, lying between the arachnoid and pia mater, and in some parts following the course of the pia mater through the whole depth of the convolutions. The pia mater and arachnoid adhered together everywhere, very firmly, by means of it. Not a trace of it could be found either on the outer surface of the arachnoid, or the inner surface of the pia mater. The arachnoid itself, when separated, presented no unusual appearance, but the pia mater was everywhere excessively vascular. There was no serous effusion, and the brain and cerebellum were perfectly healthy.

Now in this dissection there was unequivocal evidence of acute and extensive inflammation of these membranes, or I should say of the pia mater; yet the symptoms had been very obscure. The child in whom the disease occurred was convalescent from a mild attack of scarlet fever. One evening he became very feverish, and complained of his belly. Three days afterwards he had frequent *vomiting*, followed by stupor, and some convulsive movements of his face and arms, and death took place four days and a half after the feverishness began. We learn from this case, that general and severe inflammation of the innermost membrane may exist, and prove fatal, without giving rise to any violent symptoms at all.

I must trouble you with one more history, because it affords another example of what I have mentioned as being rare; viz., the effusion of the products of inflammation upon the outer surface of the arachnoid,—marking therefore very distinctly the inflammation of that membrane. It was evidently combined, however, with inflammation of the *pia mater* also. A child, eight months old, died after more than three weeks' illness, which began with fever, restlessness, and quick breathing; afterwards there were frequent convulsive affections, with much oppression; and at last severe convulsions, squinting and coma. At an early period of the complaint, a remarkable prominence of the anterior fontanelle was noticed; in the second week this increased considerably; and in the third week it was elevated into a distinct circumscribed tumour, which was soft and fluctuating, and pressure upon it occasioned convulsions. It was opened by a small puncture, and some purulent matter was at first discharged, and then bloody serum. No change took place in the symptoms, and the child died four days afterwards.

A deposit of thick flocculent matter mixed with pus was found covering the surface of the brain to a considerable extent, and lying *upon* the free surface of the arachnoid. There was a similar deposition also between the arachnoid and the pia mater, and considerable effusion into the ventricles.

In the sketches I have been giving you, I have endeavoured to furnish an outline of the phenomena which attend acute inflammation of the pia mater, or of the pia mater and arachnoid jointly. I have next to consider those cases in which acute inflammation of the whole contents of the cranium takes place; of the brain *and* its membranes; of the encephalon, in short. Of this formidable malady, sometimes spoken of as brain-fever, and technically called *encephalitis*, I shall give you some account to-morrow.

LECTURE XVIII.

Acute and general Inflammation of the Encephalon. Period of Excitement. Modes in which the disease may commence. Period of Collapse. Treatment. Delirium tremens.

ACUTE inflammation does sometimes appear to invade at once the whole of the parts that are lodged within the skull; or, beginning in one part, it extends rapidly to all the rest. As the contents of the cranium are called, collectively, the encephalon, so the disorder which I am about to consider has been named *encephalitis*. It is an uncouth appellation, but it will serve its purpose. Cullen, and many others, apply the term *phrenitis* to the same disease. You may choose between these names, taking care to remember what they signify. The malady is sometimes described as inflammation of the *membranes* of the brain. I believe this to have arisen from the circumstance that the effects of the inflammation which become visible after death, are often more striking and obvious on the surface of the brain, or in its ventricles, than in the cerebral substance itself. An *abscess* in the nervous mass can scarcely be overlooked: a *softening* of the cerebral pulp may escape the notice of a hasty or an inexpert observer: and those changes of colour which sometimes denote increased vascularity of the same part, may very easily be passed over without attracting much attention.

Phrenitis, or encephalitis, or acute and general inflammation of the brain and its membranes, as it occurs in adults, presents two periods which are marked by different symptoms, and in most instances are very distinctly observable. In the first period what are called symptoms of excitement predominate: the functions of the organ are exaggerated as well as disordered; in the second period those symptoms appear which are comprised under the term collapse. Sometimes these two sets of symptoms, instead of following each other, are more or less mixed and confounded together. But the distinction is real, and requires to be attended to.

The symptoms that characterise the *period of excitement*, are pain of the head, often intense and deeply seated, or extending over a large part of it; a sense of constriction across the forehead; throbbing of the temporal arteries; flushing of the face;

injection of the eyes, which have a wild and brilliant look; contraction of the pupils; preternatural sensibility to external impressions, amounting frequently to impatience of light, and of sound; mild or raving delirium; want of sleep; paroxysms of general convulsions; a parched and dry skin; a frequent and hard pulse; a white tongue; thirst; nausea and vomiting; constipation of the bowels.

You are not to look for all these symptoms in every case; nor to conclude that your patient has not inflammation of the brain because the phenomena which I have been enumerating do not all present themselves, or do not take place in any regular order of succession.

In fact, we find, in actual practice, that encephalitis is apt to come on, to begin I mean, so far as symptoms are concerned, in three or four different ways.

Sometimes there is a sudden alteration of manner, and the patient, complaining probably of his head, becomes all at once and furiously delirious; and fever is lighted up. These are symptoms which cannot pass unnoticed, and which immediately direct one's attention to the head. They may, however, be fallacious, as we shall see by-and-by. Furious delirium is not a very common accompaniment of encephalitis.

In other cases the first thing remarked is nausea or vomiting: and these symptoms may soon cease; or they may continue several days, and even sometimes throughout the whole course of the disease. Bitter fluids are brought up, yellow, or green, and evidently containing a good deal of bile: and whatever is introduced into the stomach, even a small quantity of the most simple drink, is immediately rejected. With this state of matters there is generally much constipation, and the bowels refuse to act except under the stimulus of strong purgatives.

It is important to attend to these symptoms; for occurring, as they usually do, with headache, they may easily deceive a person who is not previously aware of what they may portend. If the patient have not been previously subject to sick headaches, and if the epigastrium and abdomen be natural, not tender, nor distended, as they are apt to be when the stomach itself is in fault, and especially if the tongue be at the same time clean, we have the more reason to look narrowly into the case, and to suspect that some serious mischief, of which the nausea is a token, may be going on in the brain. I would observe, by the way, that where there is much vomiting of bile, persons are apt, both patients and their doctors, to blame the liver, to set down the disorder as bilious; but you ought to be aware, that whenever vomiting is often repeated, or long continued, bile is to be expected in the matters brought up. The action of the duodenum, as well as that of the stomach, is inverted; and the bile passes in the wrong direction. If you have ever suffered from sea-sickness, you must know that after the puking has gone on for a little while, bile is constantly voided.

Again, some cases of acute inflammation of the brain set in neither with sudden and great disturbance of the intellectual functions, nor with sickness and vomiting, but with a paroxysm of general convulsions, such as often ushers in an attack of meningitis. This symptom, according to Andral, is a much more certain sign of cerebral inflammation, than the occurrence of active delirium: and I quite agree with him in so thinking.

It is probable (but I speak conjecturally only) that this diversity of symptoms, marking the onset of encephalitis, may depend upon the part in which the inflammation begins: which is soon propagated from that part to the whole of the organ. I should suppose that when nausea and vomiting are the earliest symptoms, the inflammation may have taken its point of departure in the cerebral pulp; in the substance of the brain: and that when the attack comes on with a sudden fit of convulsions, the inflammation may have commenced in the pia mater or arachnoid. This is consonant with what we know of inflammation of those parts, when they are separately affected. Again, it seems to me presumable that the fewer cases which are characterised by early and fierce delirium are cases in which the inflammatory action has invaded the superficial parts of the cerebral hemispheres, the gray portions of the convolutions. I say I offer these as conjectures of my own: what it is of importance for you to remember is, that inflammation of the brain does commence in the three several ways that I have been describing.

There are some cases, however, that cannot be brought within even this general rule. They begin in some irregular or obscure manner, or with some unusual phenomenon. Andral states that he has seen a few striking instances of inflammation of the brain, of which the first sign was a sudden loss of the power of speech: and Dr. Abercrombie relates a very remarkable case in which the same thing happened. I call it remarkable, both on account of the singular manner in which the disease first showed itself, and because it furnishes an example of encephalitis produced by direct exposure to intense heat of the sun—

insolation; an event not common in our climate. It occurred in the practice of a surgeon at Selkirk, in Scotland:—

'A young man, aged 16, bathed twice, on the 5th of June, 1818, in the river Tweed. After coming out the second time he lay down on the bank, and fell asleep without his hat, and with his head exposed to the direct beams of a hot sun. On awaking, he was speechless; but walked home, and seemed to be otherwise in good health. He was bled and purged, and the next day recovered his speech, but lost it again at intervals several times during the three or four following days. He was forgetful, and his look was dull and heavy: he made little complaint, but when closely questioned said he had a dull uneasiness at the back of his head. In a few days more he had squinting and double vision, and a very obstinate state of bowels, and his pulse was 60. After further bleeding the pulse rose to 86; but he sank gradually into coma, and died on the 30th.'

The substance of the brain in general was found highly vascular, and a very considerable extent of it was in a state of softening mixed with suppuration. The ventricles were distended with fluid, and the membranes in many places were much thickened. One curious circumstance (affording perhaps some explanation of the readiness with which the inflammation was produced) was that the cranium was of very unequal thickness at its upper part. In one spot, as big as a sixpence, it was as thin as writing paper, and transparent.

However, the phenomena which I mentioned at first constitute the common and ordinary symptoms of acute inflammation of the brain and its membranes. They continue for a variable period; from twelve hours to two days, or more; and then they are succeeded by others, which characterise the second stage of the complaint, or the *period of collapse*, as it is called. These result, I apprehend, from the events and products of the inflammatory action; the violence of which is over, or abated. The patient ceases to complain of headache; instead of being excited or delirious, he mutters indistinctly, and falls into a state of stupor, from which it is difficult, and at length impossible, to rouse him. His vision and hearing are no longer painfully acute, but dull, or perverted; strabismus and double vision are not uncommon; and the pupil from being contracted to the size of a pin's head, becomes first oscillating, then widely dilated, and ultimately motionless; or the two pupils may be unequal in size. The patient is not shaken, at this period, with violent convulsions; but twitchings of his muscles, and startings of their tendons come on, and some of his limbs are agitated with tremors, or become powerless and palsied; the countenance is ghastly and cadaverous; cold sweats break out; the sphincters relax: at length the coma becomes profound, and life ceases.

The disease, when it proves fatal, as it too often does, mostly runs a rapid course. It may kill in as short a time as twenty-four or even twelve hours; or the patient may struggle on for two or three weeks. The morbid appearances met with in the dead body are very various. Serous or puriform effusion into the ventricles, or into the meshes of the pia mater; layers of coagulable lymph between that membrane and the arachnoid; softening of the cerebral substance, with pus infiltered into the softened parts; or great vascularity, shown by a pink or purplish mottling of its cut surface, giving it a stained appearance.

Let us next consider the *treatment* required for this frightful disorder.

It is quite plain that for an organ so essential to life, and of such delicate organisation as the brain, wherein changes so irreparable in their nature as many of those I have just enumerated, so readily take place under acute inflammation, we cannot hope to be of much service unless we see and treat the case at an early period. On this account it becomes exceedingly important to recognise the nature of the disease, at its very commencement; and, therefore, I have taken pains to point out to you the various forms which it may assume, while it may yet be within the reach of remedial measures.

The principal of those measures are *blood-letting, purging, and the application of cold to the head.* All the particulars of the preliminary *regimen* are to be rigidly observed; the patient should be kept as much as possible in silence, and in darkness, with his head high, and on a firm pillow. And the *remedies* are to be employed with decision and at once.

This is one of the cases in which the impulse of the circulating blood upon the inflamed organ may be diverted and diminished by topical bleeding. At any rate, such bleeding is justified by its immediate effects. Blood should be largely taken by cupping or leeches from the back of the neck, or the temples, or the mastoid processes; and these depletory measures should be repeated according to the violence or continuance of the symptoms which first demanded them. It is also one of the cases in which the application of external *cold* is found by experience to be not only a safe, but a very powerful and useful remedy. The head must be first shaved: and the mere removal of the hair is sometimes followed by a manifest abatement of some of the most urgent symptoms; of the pain, for example, and of the delirium. In cases such as I am now supposing, it will not be enough to apply wetted cloths to the head: the application must be colder than the ordinary temperature of cold water; and it may be made colder by ice; and one way of effecting a permanent reduction of the superficial heat is to put some pounded ice with a little water into a thin and flexible bladder, or into an india-rubber bag, and to lay it on the patient's head: there should not be too much ice, or its weight may be injurious. This is generally very grateful and pleasant to the feelings of the patient; and we often have the satisfaction of perceiving that, with the abatement of the external heat of the head, there is also an evident mitigation of the violent symptoms; the agitation and delirium are calmed, and the patient sleeps, or recovers his senses.

Another excellent and most effectual method of applying cold, is by pouring cold water in a slender stream upon the vertex of the head, until it produces some marked effect. Of course this, as well as all other strong measures, must be adopted with great caution, and its influence closely watched: I mean it is not to be left to the discretion, or indiscretion, of domestics and nurses. Dr. Abercrombie tells us that he has seen a strong man, submitted to the operation of this cold douche, 'thrown in a very few minutes into a state approaching to asphyxia, who immediately before had been in the highest state of maniacal excitement, with morbid increase of strength, defeating every attempt of four or five men to restrain him.' Of the effect of this measure in a somewhat different morbid condition, he gives an instance, which I will quote, because it shows, in the first place, the striking power of the remedy; and, secondly, the simple mode of applying it. A strong plethoric child, five years old, after being for one day feverish, oppressed, and restless, fell rather suddenly into a state of perfect coma. She had been in that state about an hour when Dr. Abercrombie saw her. She lay stretched on her back motionless, and completely insensible; *her face flushed and turgid.* She was raised into a sitting posture, and, a basin being held under her chin, a stream of cold water was directed against the crown of her head. In a few minutes, or rather seconds, she was completely recovered; and the next day was in her usual health.

This measure also is to be repeated, or not, according to the circumstances of the case.

Some persons recommend that a constant dripping of cold water upon the patient's shaven head should be kept up. This may easily enough be managed by means of a sponge and funnel placed a little above the head. Andral mentions his attending with another physician (M. Recamier) a young man who laboured under all the symptoms of acute inflammation of the brain. Cold water was made to drop slowly upon his head, and complete recovery took place, although no other active treatment of any kind was adopted.

This remedy, potent as it is, fails often of its purpose from the difficulty of ensuring its proper employment. The nurse sleeps; or, if awake, forgets or neglects the perpetual change and renewal of the wetted cloths: the bladder of ice is imperfectly adapted, or shifts its place as the restless patient moves his head: the dripping sponge wets the whole bed. To do the good of which it is capable—nay, not to do harm, by exciting reaction, when applied only at intervals—the cold must operate steadily, uniformly, and over a definite space. These objects seem to be attainable through an apparatus which has been devised by Dr. James Arnott, whereby cold (or, where it is wanted, heat) may be applied, with a suitable degree of pressure, or with scarcely any pressure, to any part of the body, for any required time. 'A current of water of the appropriate temperature is made to flow through a thin waterproof cushion or bladder, in close contact with the body. The water runs into the cushion from a fountain reservoir raised above it, through a long flexible tube; and again, escaping from the cushion, it passes through another tube into the waste vessel. The cushion is of a size and form adapted to the part of the body on which the water is to act; and by a particular contrivance any pressure from its weight may be prevented. The part in contact with the cushion is kept moist, either by previously wetting the cushion, or by interposing a piece of wet lint, flannel, or other bibulous substance.'

If this apparatus—which I have not yet seen in action—prove easily manageable, it promises to be of essential service in many a sick room.

In strongly recommending this efficient remedy, cold, to your adoption, you will not understand me to advise that it should supersede the use of adequate blood-letting. It is to be employed as auxiliary to the leeches or the cupping-glass; not as a substitute for either.

The third remedy which I named, that is to say, *purging*, is also of great importance and efficacy. But it must be *hard* purging. There is a great tendency to obstinate constipation in most cases; and this must be overcome, and free and frequent evacuations from the bowels obtained: five grains of calomel and fifteen of jalap should be followed in three or four hours by a strong black dose; and after that I should give, in such cases, three or four grains of calomel every four hours, and repeat the black dose at least every morning, until the symptoms gave way. If the mercury thus employed should touch the gums, so much, in my judgment, the better; but we must not, in this disease, combine it with opium, in order to prevent its passing off by the bowels.

Dr. Abercrombie uses this strong language in reference to the value of purgative medicines in acute inflammation of the brain:—'In all the forms of the disease, active purging appears to be the remedy from which we find the most satisfactory results; and although blood-letting is never to be neglected in the earlier stages of the disease, my own experience is that more recoveries from head affections of the most alarming aspect take place under the use of very strong purging, than under any other mode of treatment. In most of these cases, indeed, full and repeated bleeding had been previously employed, but without any apparent effect in arresting the symptoms.' He found the croton oil the most convenient medicine for this purpose.

Dr. Abercrombie was disposed to regard mercury as being useful in affections of the brain, chiefly in virtue of its purgative operation; and the opinions of a physician of his large experience and observing mind, must and ought to have great weight. But I must not conceal from you my own persuasion that, in the early periods of acute inflammation of the encephalon (and it is of the early periods that I have hitherto been speaking), if the mercury come in a short time to show its specific influence upon the gums, a great change for the better will often be perceived. Such is the result of my own observation. Recollect, however, that you are not to give calomel with the direct object of affecting the gums, but as part of the purgative plan, and you take the chance of its specific effect. You must not combine opium with it, for two reasons; first, you would thereby shut up the bowels, and deprive yourself of the use of one of your best weapons: and, secondly, you would incur the risk of augmenting and perplexing your patient's head-symptoms, and of puzzling yourself; since you would be unable to determine how much of the coma that might ensue was owing to the progress of the disease, how much to your remedy.

We have evidence enough of the beneficial influence of each of the three remedies that I have mentioned—the local abstraction of blood, strong purgatives, and the continuous application of cold to the head—to encourage us to put them diligently into combined operation in these very serious cases, especially when we have the opportunity of using them at an early period. Should the disorder happily yield to these measures, great care will long be required on your part, and great prudence on the part of the patient and his friends, lest the recent mischief should rekindle. A relapse is even more perilous than the first assault of the disease. Such prudence and care will consist chiefly in the avoidance and denial of all that might excite and disturb the brain; whether it be a premature return to animal food; or indiscreet and fatiguing interviews and conversations; or the too early resumption of the cares and concerns of business.

Are we to employ blisters in this disease? Not in the outset—not during the period of excitement. They only add to the irritation and make matters worse. And especially you should avoid putting them, as many are apt to do, upon the head itself, at that stage of the disease. We should not suppose, *à priori*, that they could then, and in that place, have any beneficial effect. They cannot divert the blood from the inflamed part; but they may attract it towards the encephalon. If they could be expected to do any good at all, it would be when they are placed upon the feet or legs. But this kind of revulsion is better accomplished by means of mustard poultices, or fomentations with hot water, which are often of much apparent service, in addition to the measures already spoken of. Experience confirms what reason teaches us to look for in this matter.

When, however, the patient had sunk into a state of coma, he has sometimes, in my experience, emerged from that condition after a cap of blistering plaster has been put upon his head. It is only when the violent symptoms of excitement have abated that I can venture to advise you to employ blisters: they may then be beneficially applied to the nape of the neck, or behind the ears, or to the head itself.

The symptoms which I enumerated as marking the period of collapse or sinking, are fearful symptoms; and result commonly, I imagine, from the products of the inflammation; from softening, from pressure exerted by effused lymph or serum, and the like; yet it cannot be so in all cases. The conditions on which these symptoms depend are not, necessarily, hopeless conditions. The symptoms do not always proceed from fatal disorganisation of the brain, but sometimes (there is reason to believe) from simple exhaustion of the nervous power. And this is a point of critical importance. Patients apparently moribund are occasionally saved by the judicious administration of stimulants and restoratives; of ammonia, Hoffman's anodyne, beef-tea, wine, and, it may be, of well-timed opiates. This plan of treatment you must therefore cautiously try, when an extreme degree of collapse occurs. If the structure of the brain be already seriously injured, and the disease irretrievably mortal, no harm can be done; while in doubtful cases, and when the symptoms result from mere depression of the vital power, the patient may be rescued: and this chance in his favour must not be thrown away.

Do you ask whether there be any mode of discriminating these opposite conditions, one of which is within, and the other beyond the range of possible recovery? I believe there is. If the tendency to *death by coma* be strong, the prospect is very discouraging; if, on the other hand, the symptoms that mark the mode of dying by *asthenia* predominate, you may hope to push the patient through. But to succeed, you must watch him hour by hour. Pallor, a feeble and flying pulse, extreme debility and tremors, coldness of the extremities, a want of power to respond to external impressions; these are alarming, but not absolutely desperate symptoms, especially if the mental faculties remain. Whereas profound stupor, partial palsy, profuse sweats, are of the worst omen; yet even these do not preclude the trial, together with blistering the head, of internal stimuli; and no other plan affords even a gleam of hope.

There is just one caution that I wish to mention before I leave the subject of acute encephalitis; and it applies to all cases of coma and insensibility, and especially when there is any paralysis mixed with the coma: it is, that you should daily ascertain that the bladder is emptied. Always make the attendants show you the urine that has been passed; and lay your hand upon the hypogastric region, and try whether there is any undue hardness and prominence there, produced by the distended bladder. I shall revert to this matter more particularly at some future time: and I content myself with merely suggesting its importance to you now, in all cases of head affection. If the patient *cannot* or *do not* empty his bladder, of course it must be emptied for him, by means of a catheter.

It would seem perhaps the most natural arrangement if I next proceeded to speak of such cerebral inflammations as are chronic, or partial. These forms of disease are more common, in adults, than acute and general encephalitis. I shall be obliged also to treat, separately, of inflammation of the brain as it is modified by its occurrence in strumous children,—of what is called acute hydrocephalus. But before I touch upon any of these, I am desirous to bring under your notice at once a very singular and extremely interesting complaint, which is not, in its essential nature, inflammatory, but which may easily be mistaken, and has over and over again been mistaken, for acute inflammation of the brain and its membranes, with the consideration of which we have just been occupied. The mistake is the more serious, because the remedies that I have been recommending for encephalitis, and especially the abstraction of blood, not only are not required, but are in most cases positively injurious, in the disorder of which I am now about to speak; and which is best known among ourselves under the appellation of *delirium tremens*; and among that class of society in which it is most frequently met with, by the expressive phrase '*the horrors*.' Nay, this affection of the nervous system may actually be brought on, in a predisposed subject, by the abstraction of blood. I go apparently out of my way in taking notice of this complaint now, but I do so that I may have the opportunity of contrasting it with encephalitis, while the phenomena of the latter disease are fresh in your memory. It certainly resembles it also in many respects; and even within my own recollection it was regarded as an inflammatory disorder by some excellent pathologists.

The symptoms which mark a decided attack of *delirium tremens*, and which have sometimes been found so equivocal, are very striking. You will be summoned to a man who is supposed to be mad, or to have brain fever. You find him with an anxious face, it may be red, it may be pale, with injected eyes, talking wildly and incessantly, fidgetting with his hands, affected often with tremors of the limbs, having a rapid pulse, and bathed in sweat. Now it is very natural that a person not on his guard should interpret these symptoms as indicating inflammation within the head. But if you look closely into the matter you will find in the state of the patient, and in his history, some things very peculiar. The delirium you will generally find to be, not a fierce or mischievous delirium, but a *busy* delirium: he does whatever you desire him to do, but he does it in a hurried way, with a sort of unsuccessful anxiety to perform it properly. During the approach of the malady, while he is yet able to go about, he manifests great impatience of any interference, or advice, or assistance, in his ordinary duties, which he sets about in a bustling and blundering manner. His loquacity is extreme, and he refers to matters that are not present before him. He is not altogether inattentive to the objects and proceedings that are going on around him, but his mind wanders away to other subjects. There is an odd mixture of the real and the ideal in his thoughts and language. Sometimes he is very suspicious that those who are about him intend him some injury; or he fancies that he is surrounded by enemies. You will find also that he does not sleep; that he has not slept perhaps for several nights, but has been restless and rambling: and you will generally learn that he has been habitually intemperate, or subject to some great source of care, or anxiety, or excitement: and in many cases he has recently been somehow or other debarred, or he has refrained, from his customary stimulus. In addition to these points in his history, you will sometimes be told that having been unwell, first he has been kept upon low diet, and then, as the delirium came on, he has been freely bled; and that he has been none the better, but much the worse, for the bleeding. When you gather such particulars as these from his friends (for upon his own statements you cannot place any reliance), and when you find the delirium to have the characters I have been attempting to describe, and especially when there has been obstinate watchfulness, and the tongue is moist, and the skin is sweating, you may be certain that your patient is affected, not with inflammation of the brain, but with delirium tremens; and that if you bleed him further you will harm, instead of helping him.

But what are you to do under such a fearful state of things? Why, the great indication is to procure sleep; and the remedy to which you would naturally turn for that purpose, I mean opium, you will find to be not seldom successful. The beneficial effects of this drug, in tolerably favourable cases of delirium tremens, are really surprising. I will give you an example or two, which will be more instructive than any abstract description.

In the year 1831, I was requested by a most respectable practitioner in this town, to visit a patient of his whom he reported to have had phrenitis, for which he had been freely bled, cupped from the back of the neck, and purged; and who, he believed, was now rapidly sinking, and not likely to survive many hours. I found the patient, a middle-aged man, with a red face, ferretty eyes, a frequent pulse, bathed in perspiration, busy with his hands, which trembled a little, and talking much and incoherently. He was particularly anxious that his legs should not be scarified, told me he was willing to do anything I pleased, if I would not scarify his legs, nor let anyone else scarify them. There was nothing the matter with his legs, nor had it entered anybody's head but his own, that they wanted scarifying. He had not slept for several nights. He had been intemperate, especially of late, drinking a good deal; and somewhat anxious about his affairs: he was a builder.

His former history was not very promising. He had brought up a good deal of blood a few months before, and some years previously he had had jaundice; latterly he had been troubled with indigestion.

I saw him in the afternoon, and prescribed one-third of a grain of morphia: in the evening he was just in the same state. I then directed half a drachm of laudanum to be given immediately, and twenty drops every two hours afterwards, *till he slept.* I said to the gentleman who had called me to the case, that I thought it very likely our patient might be well the next day; he smiled, and shook his head. I was obliged to leave London early the next morning, for two or three days: on my return, I learned from the medical man that the patient took five doses of the laudanum, after which he fell asleep, and slept soundly, and for a long time, and then awoke (to his attendant's extreme surprise and satisfaction) sane and well.

I was asked by the apothecary of the Middlesex Hospital to see a publican in that neighbourhood. I found a large strong man between 30 and 40 years of age. He had been without sleep for several nights, somewhat incoherent, and (what is not usual in such cases) violent; threatening and striking those about him because they refused him access to strong drink. He was joint proprietor with another in a gin-shop, and for some time previously he had been a sot, and daily muddled with drink. He told me he was quite well. There was not much tremor. I found that the object of his partner and relations in sending for me was that I might sanction his removal to St. Luke's, for his strength made him altogether unmanageable, and his insane and extraordinary conduct was hurting the business of the house. I declined to take any part in consigning him to a mad-house, and recommended morphia. After one full dose he soon slept; and the next day he was quite rational, and comparatively well.

These are the broad outlines of delirium tremens: there are many other features wanted to complete the portrait of the disease; which I shall endeavour to paint at our next meeting.

LECTURE XIX.

Delirium Tremens, concluded. Chronic Inflammation of the Brain. Softening, Suppuration, Abscess, Induration, Tumours in the Brain.

I DREW a rude outline, yesterday, of that strange and interesting malady usually denominated *delirium tremens.* The disease is very common in this country; for its causes are in common and powerful operation. You will meet with it in every walk of life: and you will be almost sure to witness several examples of it during the course of every year, in any of our metropolitan hospitals. It is not a chronic or vague complaint, likely to be treated with *placebos,* or by waiting upon nature. Active measures are pretty certain to be adopted; and, in many cases, one plan of treatment, vigorously pursued, will hurry the patient to his grave; another plan will restore him to health with an almost magical celerity. It certainly bears a strong resemblance to that most formidable disease, inflammation of the brain and its membranes: but the great remedy for encephalitis acts like a poison in pure delirium tremens; and the drug, by the timely and careful administration of which we can often promise a speedy cure in delirium tremens, is one which we must carefully avoid, in the earlier treatment at least, of encephalitis. Accuracy of diagnosis, therefore, between these different disorders with similar outward signals, becomes of the very highest importance.

Delirium—tremens.—There is delirium always; and there is generally, but not always, tremor. The name is a good enough name, in my humble opinion; yet it has been found fault with, because the trembling is not in all cases present: and some have, therefore, christened it *delirium è potu,* or *delirium ebriositatis.* But these terms are open to just the same objection as the other; for though the disorder is most commonly connected with intemperate habits, that is not always the case. One very curious fault has been discovered in the name: it is said that the delirium cannot *tremble*; and, therefore, that it is better to say, *delirium cum tremore,* or *tremefaciens*: and you would hardly suppose it, but there has been a sort of contention for the honour of thus mending the nomenclature of this disease.

But they who object to *delirium tremens* appear to see no harm in *delirium ferox*: whereas it is just as incorrect to say *delirium* is fierce as to say that it trembles: it is the patient who is furious, even as it is the patient who trembles; and all this dispute about a name is mere trifling. It matters not what we call a disease, so that the name conveys no erroneous theory as to its nature or proper treatment. No such source of error attaches itself to the term delirium tremens; and, therefore, if it be only to avoid the inconvenience of change, we will adhere to that term.

Recollect that the strong features of the complaint are sleeplessness; a busy, but not angry or violent delirium; constant chattering; a trembling of the hands, and an eager and fidgetty employment of them. To these are added other symptoms which, though they are not so calculated to strike a looker-on, are of not less importance, inasmuch as they help to establish the diagnosis. The tremulous tongue is moist and creamy; the pulse, though frequent, is soft; the skin is perspiring, and most commonly the patient is drenched in sweat. The sweat is usually described as having an offensive or a peculiar smell: I cannot say that I have observed it to be so. The face also is said to be pale; but that, I know, is not always the case, and therefore this point cannot be relied upon as a distinguishing circumstance. In one of the instances which I related in the last lecture, the face was flushed, and the eye red and ferretty.

Let me remind you, in a few words, of the peculiar characters of the delirium. If you question the patient about his disease, he answers quite to the purpose; describes, in an agitated manner, his feelings, puts out his tongue, and does whatever you bid him: but immediately afterwards he is wandering from the scene around him to some other that exists only in his imagination. Generally his thoughts appear to be distressful and anxious; he is giving orders that relate to his business to persons who are absent; or he is devising plans to escape from some imaginary enemy. He is haunted by ocular spectra; fancies that rats, mice, or other vermin are running over his bed; sees spiders crawling on the ceiling, or a horse's head thrust through the wall of his room. He addresses remarks to strangers whom he erroneously believes to be present. He looks suspiciously behind the curtain, or under his pillow, and he is perpetually wanting to get out of bed; but he is readily induced to lie down again. It is seldom that he meditates harm, either to himself or to others: there is rather a mixture of cowardice and dread with the delirium. I shall never forget the markings of terror expressed in the features of one patient, whom I visited in the middle of the night at an hotel near my house, in consultation with the late Sir George Tuthill, and who declared that the Devil in person was menacing him from a corner of the room.

All the points that I have been mentioning require to be investigated in every case of this nature: and an enquiry into the previous history of the patient, into what the French call the commemorative symptoms, is equally important. In a large majority of instances you will find that he has been an habitual drunkard; and very frequently that from some cause or other this habitual stimulus has been diminished or abandoned. Some accidental illness has befallen him, and he has been restricted to low diet, and, as a sailor would say, 'his grog has been stopped.' When, with symptoms such as I described just now, you hear a history of this kind, you may be satisfied that the disease is not inflammation of the brain, but delirium tremens. I believe that habitual intoxication of any sort may lead to this disorder; but distilled spirits more surely than wine, wine more than beer. I think it probable also that what is alleged of the habitual use of opium, in preparing a person to suffer in the same way upon its being withheld, may be quite true, although I have had but few opportunities of noticing such cases.

But the disease is not confined to drunkards, although it is so commonly connected with that pitiable vice, as to have been called *mania à potu*. You meet with it occasionally in men who have overstrained their nervous system by other modes of strong excitement. Long-continued mental anxiety, that state of mind in which gamblers and great speculators (who indeed are gamblers) are accustomed to live, may cause it; anything by which the mind is over-wrought. A well-informed medical man, of temperate habits, told me that he was on the brink of delirium tremens in the year 1825. He had foolishly entangled himself in some of the speculations which prevailed here like an epidemic at that period, and his mind was on the tenterhooks of suspense and apprehension for some time. He could not sleep, and he found himself 'everlastingly chattering.' It comes on in the course of certain diseases; as sometimes, for example, in apoplexy: and it is a very common result of bodily injuries and accidents, and of surgical operations: or, I should rather say, that it often *follows* such diseases and casualties;

for it is, even then, the consequence of the treatment and regimen to which the patients are subjected, rather than of the surgical or medical complaint. And it is certainly *more* apt to occur, under these circumstances, in old people; and in those who, being younger, are known to have been intemperate. So frequently does the delirium manifest itself upon the cessation of the accustomed spur, that the continually recurring stimulus has been regarded as the *predisposing*, and the privation of that stimulus the *exciting* cause of the affection. Sometimes, however, it comes on in men who are perpetually fuddled, even although they have not intermitted their usual indulgence in drink. We had a porter (an old soldier he had been) at the Middlesex Hospital, who was of great use to us as a subject to practise upon, and to show to the pupils. I never saw him so drunk as to be unable to perform his duties: but I cannot conscientiously say that I ever saw him sober. Every three or four months we were sure to have him in the wards with delirium tremens. Sometimes he fell into the hands of one physician, and sometimes of another; but in one of his attacks he slipped through our fingers. I am not certain that he was not nominally my patient on that last and fatal occasion: but assuredly he never exemplified the coming on of the disease from the adoption of more temperate habits. We often find that the malady shows itself immediately after an unusually severe debauch, which has disturbed the stomach and bowels, and left behind it a proportional degree of exhaustion and languor.

Without knowing why it should be so, my own experience would lead me to the belief that delirium tremens is very uncommon among women. The number of beds for women in the physicians' wards of the Middlesex Hospital is somewhat greater than for men. On the men's side of the house cases of delirium tremens are very frequent: whereas I scarcely remember any on the women's. Yet each sex is obnoxious to its main causes. The gin-shops of this town are said to draw a fearful crowd of votaresses. And we might expect that the more sensitive character of the female frame would render women especially liable to this peculiar consequence of the abuse of alcohol. My experience, however, is such as I tell you. On the other hand, Dr. Roots thought he had seen quite as many instances of delirium tremens attacking women as men. The result of M. Rayer's observation is more in accordance with my own. Of 176 patients seen by him, seven only (not one in twenty-five) were women. A still smaller ratio is recorded by

Bang, ten in 456: less than one in forty-five. The disorder appears to be more common in the summer than in the winter months.

The peculiar nature of the complaint, and the proper method of treating it, were first brought into general notice in 1813 by a little work of Dr. Sutton's, of Greenwich. He saw a good deal of the diseases of the smugglers, and of the customers of the smugglers, who frequented the coast of Kent; and he was struck by the different event of this disorder in the hands of different practitioners, according as bleeding, or narcotics, were adopted. It is the same disease which Dr. Abercrombie speaks of as 'a dangerous modification of meningitis, which shows only increased vascularity.' Dr. Bright also includes it among his cases of 'Arachnitis.' Both these eminent physicians had learned, however, that the complaint requires a particular method of treatment.

I said, in the last lecture, that what we most wish for, when watching a patient in delirium tremens, is that he should *sleep*; and that our most eligible means of helping him to sleep are to be found in opium. But this brief maxim is not to be received without reserve and limitation. The latter part of it has been challenged as unsound. I must tell you that the nature, tendencies, and right treatment of this disorder have, since I first begun to lecture upon it, been carefully investigated and discussed by many competent writers in this and in other countries. Especially has its *natural history* been studied and described. Formidable as the disease unquestionably is, it is not so full of danger as the symptoms, in the severer cases, might seem to bespeak. As early as the year 1831, Dr. Ware, of Boston, in America, had watched the progress and behaviour of delirium tremens when left to itself—I mean when uninfluenced by drugs; and he states as the result of his experience in numerous cases, that it is what has been called a *self-limiting* disease; that it runs a tolerably fixed course, and tends to terminate in spontaneous sleep within a certain period, which he puts at from two and a half to three days. Dr. Peddie, of Edinburgh, bears similar testimony. He found the acute paroxysm to occur with remarkable uniformity, and to come to an end on the second or third day; sometimes earlier; rarely later than the fifth. The subsequent observation of Professor Laycock, of Dr. W. T. Gairdner, and of others, accords with these most interesting and most important statements. They tend to put delirium tremens into the category of those diseases which naturally end in recovery or in death, within a definite period of time.

Again, I have been in the custom of telling you that 'the only morbid condition which I had found constant in persons dead of delirium tremens was a remarkably soft, pale, and flabby state of the muscular tissue of the heart.' It has now been ascertained, with more exactness, that fatty degeneration of the heart is a very common accompaniment of delirium tremens. It is, no doubt, one result of those habits of life, of that course of chronic poisoning, to which the nervous disease also owes its origin. This state of the heart it is also most important that we should recognise, for it constitutes the great danger of the disease, which thus tends to death by exhaustion, or asthenia.

The conclusion to be drawn from these facts is—not that the disorder should be left to run its course unchecked by medicine, but that the sleep which proves critical should be promoted, and, if possible, ensured and anticipated. The earlier it comes, the less there will be of effort and struggle on the part of the patient, and the less risk of fatal exhaustion. With this object of procuring sleep, must always be associated that of sustaining the patient by judicious feeding. Unluckily, the bad habit which is at the bottom of almost every one of these cases, takes away all appetite for food. When it is not so, when the patient will and can eat and digest wholesome food, the disease loses nearly all its danger. In general, it is necessary to ply him with nutriment that he can *drink*—hot beef-tea, spiced with cayenne pepper, and the like. The less of nutritious food that he can be persuaded to swallow, the more is the need of conciliating sleep. And there is no reason, save one, that I am aware of, why opiates should not be given for that purpose —and the one is, in plain terms, the fear of poisoning our patient by them. This is a fear which, for my own part, I do not remember to have seen verified in practice; yet I can well conceive, and I frankly admit, the hazard. It is, however, a hazard which, incurred to avoid other hazards, may itself be now easily avoided. 'Out of the nettle danger we pluck this flower safety.' Formerly, indeed, under the old plan of giving opium by the mouth, we never could be sure how much of it might lie inert in the stomach, and, after accumulating there, be suddenly, perhaps, taken into the system. But since the felicitous method of injecting the salts of morphia (or other medicinal substances) into the subcutaneous tissue has been invented and made easy, we can so soon and so accurately measure, appreciate, and limit, the influence of the drug, as to resort to it without misgiving. If, after a fair trial, the injection, for example, of a quarter of a grain of the muriate of morphia, once perhaps repeated, we observe no earnest of amendment, and learn at the same time, from the diminished pupils of the patient's eyes, that the remedy is not inoperative, we prudently push it no further.

You will look narrowly, then, into the eyes of your patient in delirium tremens before, and after, you put opium into his body. And, further, *before* doing so, you must enquire, with no less vigilance, into the condition of other twin organs of his—I mean his kidneys. Many of the unhappy subjects of delirium tremens are affected also with that chronic disease of the kidneys, called Bright's disease, which I have already mentioned in these lectures, and of which I shall have much to say in future. The continual depuration of the blood depends greatly, as you know, upon the kidneys; and if their structure be spoiled for that purpose, if the exit of impurities from the body through that channel be dammed up or obstructed, as it is in Bright's disease, the introduction of any potent medicine which might become dangerous by its accumulation in the blood, must then be doubly dangerous. If you find albumen in the urine of your delirious patient, beware of giving him opium.

I have already referred to the peril of exhaustion, increased by the restlessness and bodily efforts of the patient, which are sometimes incessant, and very difficult to control. Of course it is desirable that he should be kept in bed, in a darkened and silent room. But in bed he sometimes cannot be persuaded to remain, and it may become necessary—and a most unfortunate necessity it is—to restrain his movements by force, to confine him to the bed by straps, or to muffle his limbs in a straight waistcoat. But physical coercion of no kind whatever should be resorted to, when by any means it can be avoided. The angry feeling and mental fret that it produces, and the exhausting struggles to escape or to resist the thraldom, are always highly injurious, and add sensibly to the patient's danger. A couple of strong and good-tempered attendants may exercise more gentle and more effectual restraint and persuasion upon the sick man than the ruder force of manacles; but, after all, the best restraint, is the calm which an opiate may bring, when its use is not clearly forbidden. Padded rooms, in which the patient may be left free, are recommended, but these are rarely to be found.

A still further danger there is, which the same opiate remedy might afford a prospect of averting, but which else must be averted by unceasing watchfulness. These patients, though generally harmless as respects both themselves and other persons, are sometimes full of gloomy thoughts and suicidal propensities—or they will rush with frantic terror into actual dangers to escape the unreal perils with which their imaginations are haunted. I am tempted to quote from a published lecture of Dr. Johnson's, a striking illustration of the twofold danger that I have been speaking of:—'Dr. Budd was in the habit of mentioning in his lectures a tragedy which occurred in the *Dreadnought*, when he was physician to that hospital ship. Sailors, as you may suppose, are, from their known modes of life, very liable to delirium tremens. Three such sufferers were in the vessel at the same time. One of them suddenly cut his own throat. Another, excited and terrified by the commotion which this event produced in the ward, jumped through a port-hole into the Thames, and swam away vigorously towards the shore. Some men put after him immediately in a boat, and picked him up; and having brought him to the ship's side, they were about to take him up the ladder, when he made violent resistance, and while doing so suddenly fell dead in the boat.'

Is a patient, in a paroxysm of delirium tremens, to be allowed a moderate quantity of, or to be absolutely debarred from, his accustomed stimulus? This is a question that requires, and I think admits of, a definite answer. Whenever, as is sometimes the case, the intemperate use of spirits has continued up to the very outbreak of the paroxysm, it should be stopped at once, and the result carefully noticed. There is abundant evidence that the habit of drinking to excess may be abruptly arrested without detriment, nay with manifest advantage, to the drunkard's general health. But it would be rash and illogical to infer from this, that there are no *conditions* of delirium tremens in which spirits can be useful, or are even admissible. The opiate treatment, heedfully adopted, is sometimes, of itself, sufficient for its object; sometimes it is not, the patient remaining wakeful, agitated, and trembling, till it is supplemented by a single administration of the customary dram—'a hair (as the vulgar saying goes) of the dog that bit him'—a glass of gin, or a pint of porter; after which he presently sleeps, or becomes calm and steady. Facts of this kind—which are not mere coincidences—have been too often witnessed to admit of doubt about them. Now these are cases of which the distinguishing characters are not hard to recognise. They occur in persons who are of pale and haggard aspect, with a small and weak pulse, and no appetite for food. They present the phenomena of physical exhaustion combined with, and aggravating nervous irritability. The feeble circulation and waning strength cry out for some temporary stimulus. We should not hesitate if we met with a similar condition without the delirium; and with it, the proper practice is no less clearly indicated.

If the patient's appetite be unimpaired, if he can take and appropriate good nourishing food—strong broths, and the like—the stimulant may be rightly withheld. And in no case are ardent spirits to be persevered with as a part of the general treatment, but abandoned, or suspended, as soon as the immediate benefit has been secured. It has been well observed by Dr. Johnson, that the paroxysm of delirium tremens is not always or purely a toxæmic condition. The delirium of intoxication—which is the direct effect of the presence of a certain quantity of alcohol in the blood, is quite a distinct thing from the delirium which we designate by the epithet tremens, and which is a remote and indirect effect of the habitual abuse of strong drinks, whereby at once the nutrition of the brain, and the muscular powers of the body have been lessened and impaired.

I have drawn the line between encephalitis and delirium tremens with sufficient clearness, because I have taken well-marked forms of each. But I am obliged to add that there are mixed cases, which are very puzzling when they occur, and exceedingly difficult to treat; and which may require opiates on the one hand, and moderate depletive measures on the other. When the indications are uncertain, or equivocal, we must carefully weigh the different symptoms, and we must cautiously *try* the remedies. The circumstances that most distinguish the one form of the disease from the other are to be found in the *pulse*; which is hard and resisting in the earlier stages of inflammation of the encephalon, soft and compressible in delirium tremens: in the *tongue*; which is mostly parched and rough in the former, moist and creamy in the latter: in the *skin*; which is hot and dry in the one case, covered with sweat in the other: in the *countenance*; which is flushed in inflammation, and mostly (though not always) pale in delirium tremens: in the *tremors*; which are not common in the primary periods of inflammation of the brain: in the usual absence of *headache* in delirium tremens: and in the peculiar characters, which I need not recount, of the *delirium* in the two cases. If these symptoms contradict each other, as they sometimes will, you had better act on the *worst* supposition, and presume that there is inflammation, and employ its remedies: but you must not do so with a strong hand; you must use them cautiously, and watch their effects, and guide thereby your subsequent treatment. Apply a few leeches behind the ears; put cold or evaporating lotions to the head; and note the condition of the patient afterwards. You will sometimes find a state resembling delirium tremens left after the subsidence of acute inflammation of the parts within the cranium, and requiring the treatment of delirium tremens.

The points of distinction just enumerated are obvious to the senses, and easy to note. Another, and probably a surer criterion than any or all of them, has been brought to light in some highly interesting researches of Dr. Bence Jones'; but, unfortunately, it is not self-evident, nor readily elicited. I allude to the contrast which Dr. Jones has shown to exist between the two diseases, in respect of the amount of earthy and alkaline phosphates excreted with the urine. In the severest cases of delirium tremens there is a marked diminution of these phosphates—in acute inflammation of the brain a considerable increase. Taking the average from three examples of each disease, the difference was in the proportion of 1 to 12. The extremes presented the extraordinary ratio of 1 to 223. Dr. Jones concludes that the 'excess of phosphates may be regarded as resulting from inflammatory action going on in the brain, while the diminution of the same phosphates in delirium tremens must be considered as caused by the positive hindrance of that process of formation of phosphoric acid which in the healthy state is continually taking place.'

I do not know that there is much good to be expected from counter-irritation in this disease. But after the more decided symptoms were gone by, I have sometimes thought that the recovery has been accelerated by the application of a blister to the nape of the neck.

Inflammation of the brain, and delirium tremens, are distinct diseases. Hence, in the mixed cases, of which I just now spoke, we may expect after death to find, and we often do find, unquestionable traces of inflammatory action within the skull. But pure delirium tremens frequently leaves behind it no morbid appearance whatever in the brain or its membranes. In other cases there is serous liquid collected in the interstices of the pia mater, or in the cerebral ventricles; and I have on several occasions seen the arachnoid thicker and less transparent than is natural, and sprinkled over with little spots or streaks of a milk-white colour. Changes of this kind we believe to be owing to chronic inflammation of the membrane. But, even in these cases, I see no reason for thinking that the fatal disorder had any connection with the morbid state of the arachnoid. We meet continually with like appearances when there has been no delirium tremens; and we have delirium tremens without any such appearances. The habitual abuse of ardent spirits leads to chronic inflammation in various parts and tissues of the body: in the blood-vessels, in the liver, in the kidneys, and in the arachnoid. We need not be surprised at finding that membrane thickened and partially opaque in the victims of delirium tremens; since they are chiefly men who have run a long course of intemperance. I believe that disease to bear the same relation, and no other, to the chronic arachnitis in such persons, as to the chronic hepatitis to which they are equally subject. I have already stated that there is but one morbid condition which, so far as I know, is almost constantly to be found in persons dead of delirium tremens, and that is, fatty degeneration of the muscles, and especially of the muscular tissue of the heart. Mr. Solly tells us that 'in all the cases which he has had the opportunity of examining after death, he has invariably found the hemispherical ganglion, or cortical substance, (of the brain,) pale and bloodless.'

The chemist may be more likely to detect altered conditions in the brain, in these cases, than the anatomist. Dr. Percy has obtained alcohol from the brain of a person who died from excessive drinking; and from those of various animals which had been killed by that poison. These facts are interesting, but they do not help us much in our attempts to explain the phenomena of the disorder.

There are other remedies vaunted as specifics in delirium tremens. You will hear or read of large doses of digitalis soon followed by the desired sleep. Half an ounce of the tincture, for instance. I confess to you that, though I have no fear of opium, in uncomplicated cases properly watched and regulated, I do not dare to prescribe digitalis in that way. That it has seemed to effect a speedy cure I do not question; but, in my judgment, it is a hazardous remedy. Its successes we hear of; its ill fortunes are not so likely to be told.

There is, however, one drug, of which, in relation to delirium tremens, I cannot speak from any experience of my own, but of which I should not hesitate to make trial in cases where the sleeplessness was obstinate, and the use of opiates precluded or ineffectual. I mean the bromide of potassium, which I would give in large and repeated doses—half a drachm, or a drachm or more. This is a perfectly safe remedy; and on many occasions of ordinary morbid wakefulness, since I first read Dr. Begbie's strong praise of it, I have found it very efficacious in restoring the lost blessing of sleep.

I should wish to put you next in possession of what has been ascertained in regard to *partial* and to *chronic* inflammation of the brain, as these are met with in adults; for I must speak of some head affections of children separately. But I really do not know how to bring this part of the subject before you in a practical manner. If I were first to describe symptoms, and then to state what organic changes had been discovered after death preceded by them, I should have to tell you of different symptoms with the same morbid conditions, and of the same symptoms with different morbid conditions, in various individuals. I believe the best method, upon the whole, will be to describe the several morbid appearances which the brain is found to present; and then to mention the symptoms that have *most commonly* been observed to occur in association with such morbid conditions. I must premise, however, that the whole subject is full of uncertainty and apparent irregularity. Doubtless there *is* some constant and uniform connection of cause and effect between the altered physical states of the brain, and the altered manifestation of its functions: but we have not yet been successful in our search after those settled relations, or we have but partial and imperfect glimpses of them.

One very remarkable condition of the brain has been several times mentioned in these lectures; viz. *softening—ramollissement.* A great deal of attention has been paid to this condition of late years, both in France and in this country: and some points in its pathology have been fairly made out. I will bring them together as concisely as I can. In the first place, the softening varies greatly in degree, from the consistence which naturally belongs to the cerebral substance, to that of thin cream. In its minor degrees it may be easily overlooked; and is more perceptible by the touch than by the eye. The cerebral matter is less coherent, but it is not yet discontinuous or broken down. It may be washed away, however, by letting a slender stream of water fall upon it; and the softened parts are thus easily distinguishable from those which retain their natural consistence. In the next stage of softening we recognise the complaint at once, for the softened parts undergo a change of form by their own weight: parts that are prominent in the healthy state, as the optic thalami, corpora striata, and convolutions, sink down, as it were, and are more or less flattened. If you make a horizontal section through a part thus diseased, a portion of the softened brain adheres to the knife, and is removed by it, and a depression is left. In a still more advanced degree, the natural texture of the organ in the softened part is entirely destroyed and confused by the change, diffluent: you may pour the softened matter out.

The *colour* of the softened portions varies also considerably. Sometimes they are unchanged in colour: sometimes they are quite white, and present a strong contrast with the tint of the neighbouring parts: sometimes they are marked with various shades of redness, from a rosy pink to an orange, or deep red, or even a mahogany brown. Often there are red spots mixed irregularly with the softened cerebral pulp, and giving it very much the appearance of a mixture of raspberries and cream. In other cases we find the softened mass of a pale yellow, or straw colour, infiltered, as it were, with purulent matter: and sometimes it is mixed with serous fluid.

Now, it is well established that softening of the brain is a common result of two very different morbid conditions. It is often caused by inflammation of the softened part: it is still more often caused by what I may call its starvation; by the diminished supply of arterial blood, in consequence of diseased, or of plugged blood-vessels.

Can we distinguish these two forms of softening from each other simply by their physical characters? Sometimes we can: and sometimes, it must be confessed, we cannot.

Softening of the brain is usually partial: but this will not help us, for the parts that are most liable to have their consistence diminished through an inflammatory process, are the very parts that are most liable to be softened from defect of nutrition. The most vascular parts of the brain, in short: the gray matter of the convolutions, and the gray matter of the thalami, and corpora striata.

It is stated, however, that softening of the septum lucidum, and of the fornix, very frequently accompanies an accumulation of serous fluid in the lateral ventricles, and very rarely results from disease of the cerebral arteries.

If there be pus mixed with the softened brain, we know that there has been preceding inflammation. Again, if we find the arteries impervious, or unsound, we conclude that the softening has not been inflammatory. Sir R. Carswell states that obliterated arteries may occupy the softened cerebral substance, and often be seen ramifying through it; and that when this substance is removed by pouring water upon it, the solidified vessels retain their situation, and feel sometimes as hard as fine wires. But a much more common condition is that fatty degeneration of the minuter blood-vessels which I spoke of in a former lecture; and this may often be detected by examining, under the microscope, the softened piece of brain. We come to the same conclusion if, no microscope being at hand, we find the cerebral arteries that lie beyond the circle of Willis, obstructed by atheromatous or ossific deposit; or by a clot of fibrin; and a large portion of the brain unnaturally soft.

We have no certain test of the nature of the softening in its being red. The redness may be the result of inflammatory congestion: but cerebral hæmorrhage may occasion softening; and, on the other hand, softening may give rise to cerebral hæmorrhage. *This* may be said, however: that when the softening extends much beyond the redness, or the effused blood; or when the redness occupies several small portions only of the softened pulp; we may presume that the blood was extravasated subsequently to, and in consequence of, the softening. On the other hand, when redness and vascularity can be traced into the brain, some way beyond the softened part, we may regard the softening as the consequence of inflammation. And we adopt the same belief with still greater confidence, when around the softened and disorganised pulp we find the cerebral substance *hardened*, and of a uniform reddish colour.

In attempting to make the diagnosis between these two forms of softening, we get some assistance by noticing the *age* of the patient. Degeneration of the arterial tissue is almost peculiar to the advanced periods of life; whereas inflammatory softening may occur at any age; in children, in adults, or in old persons. But then the sealing up of a cerebral artery by a bit of lymph or fibrin may also happen at any age.

When you find the softened substance infiltered with purulent matter, you may call the case one of *suppuration of the brain.* But suppuration also occurs in another form; viz., in the form of circumscribed collections of pus in the substance of the encephalon; of chronic *abscesses.* They are not, however, of very common occurrence. Nearly always they are secondary consequences of injury done to, or of pre-existent disease in, the *bones* of the head: of fractures of the skull; of blows or falls which have caused concussion of the brain; most especially of chronic disease, at length reaching the brain, of the petrous portion of the temporal bone connected with the ear—or less frequently of chronic disease of the œthmoid bone of the nose. These are *pyœmic* abscesses. They are often found in parts of the brain quite separate, and even distant, from the part originally diseased, or hurt: and if the primary disease does not kill, they may be latent for weeks or months. Probably this latency depends in part upon the situation of the abscess. Dr. Hughlings Jackson makes the important remark that whereas cerebral *hæmorrhage* happens chiefly in what may be called the *arterial* districts of the brain, cerebral *abscesses* lie generally in its *venous* districts. They seem sometimes to result from plugging of the cerebral veins. They may give rise to no symptoms, or to none that attract notice, during life, and be discovered only after death from some other disease. When they do lead to noticeable symptoms, these are rarely distinctive, but are such as are liable to arise from the presence in the brain of any 'foreign body.' That is—the abscess is gradually followed by morbid changes in the brain-stuff immediately around it; and the symptoms then observed are really the signals of these morbid changes. Occasionally a cerebral abscess announces its existence, and produces alarming symptoms, by bursting suddenly into an adjacent ventricle, or over the surface of the convolutions.

Partial inflammation of the brain, especially when it is chronic, sometimes produces a totally different change from any that have yet been described. Instead of becoming softer, or being converted into pus, the inflamed part is *indurated*; comes to resemble in consistence portions of brain that have been for a short time immersed in weak nitric acid. In this state it is often unusually vascular and injected with blood. When the induration is greater in degree, the hardened part assumes the appearance of wax, or of boiled white of egg, or (as Andral says) of Gruyère cheese, and contains but little blood, but is, on the contrary, distinguished by its pearly whiteness. That these changes are the result of slow inflammation is the more probable, because they are sometimes found to exist around an old apoplectic clot or cell; the blood effused having acted as a cause of inflammation of the neighbouring part, just as any foreign substance might do. In the progress of cases in which partial induration is effected, convulsive movements are common, but paralysis does not appear to be so frequently present. The symptoms may go on for months, and often remit, and are again aggravated by paroxysms. These cases are the more interesting, because they offer a greater probability of cure than those that are attended with an opposite condition of the cerebral mass.

Besides these varieties of inflammation, and their consequences, the brain is often infested with *tumours*, which also give rise to a great diversity of symptoms. There are fibrous tumours which grow rather *around* the nervous matter than within it, and are connected with the dura mater. They have been found at almost all parts of the surface of the brain; at its base, at its sides, and towards its summit. Scrofulous tumours are also not uncommon: these are embedded in the nervous substance, and assume a round form, for the reason formerly mentioned, viz., because the tubercular matter that is separated from the blood is not cast into any particular mould (as it is when it is effused into the small bronchial tubes), but is poured forth into the homogeneous pulp, which exerts an equal degree of pressure upon it on all sides. These scrofulous tumours of the brain are much more frequent in children than in adults; and they are more commonly met with in the cerebral hemispheres than in any other part of the brain; occupying the cortical and medullary substance indifferently. They differ from pulmonary tubercles in this respect, that they are seldom numerous in the same brain. Sometimes one only is found. They vary in magnitude from the size of a large pin's head to that of a hen's egg; and they are sometimes even bigger than that. The substance of the brain immediately surrounding these tumours may be unchanged, in which case it is probable that the tumours themselves give rise to no particular symptoms, the cerebral matter of the spots which they occupy having been gradually absorbed to make room for them; but at length important alterations take place in the neighbouring texture; congestions of blood, or softening, or suppuration; or pressure is exercised upon parts that are essential to sense or motion; and then the ordinary consequences of these changes declare themselves outwardly.

Of minute tubercular deposits upon or beneath the membranes of the brain, in strumous children, I shall have much to say in the next lecture.

Cancerous tumours occur also in the substance of the brain. They usually occupy a large portion of it before they extinguish life. Hydatids are sometimes found there.

Again, it is one of the discoveries of modern times that the virus of syphilis is capable of causing organic disease in various internal parts of the body, and in the brain among the rest: local thickenings and local deposits which apparently have their primary seat in its connective tissue.

Now of the occurrence of these various local maladies of the brain it is necessary that you should be aware, for you may expect to meet with them frequently in practice. And it is right that you should also be aware that they do not disclose their precise nature by any distinctive symptoms, or succession of symptoms. They all are apt to disturb, sooner or later, the functions of the organ in which they are situated; and they may all disturb them exactly after the same fashion. There are certain symptoms which, in their concurrence, or in their sequence, clearly indicate this, and no more—that organic disease is present within the head: pain of the head, to wit; squinting; extreme dilatation, extreme contraction, or unequal size of the pupils; vomiting; convulsions; some form or degree of paralysis. They do not, of themselves, tell us *what* the disease is, but the paralysis, if there be any, may sometimes point out *whereabouts* within the head it probably is. It is a reasonable belief that the same amount of local damage done to the same portion of the nervous substance, will always, whatever may be its cause, give rise, *cæteris paribus*, to the same set of symptoms. Now our judgment respecting the exact diagnosis, the prognosis, and the appropriate treatment of any actual case—upon which points the mere symptoms throw no light—may often-times be greatly helped by ascertaining the collateral circumstances of the case. We know, for example, from our first enquiries that there is *brain-mischief*. We learn, further, that before the symptoms came on, sometime before it may be, our patient had received a stunning blow upon his head; or that he had been subject to a chronic discharge from one of his ears, or to chronic disease of the bones of his nose: or, perchance, that he has had some accidental suppuration, suggestive of pyœmia, in some part of his body: in any of these cases we conclude that there is *abscess* of the cerebral pulp. Or we find marks of the poison of syphilis on his skin, in his mucous membrane, in his bones, or hear of bygone syphilis, and we infer the probability of *syphilitic disease* of the brain or its investments. In this case, the prognosis will be better than in the last, for the disease may yield to the iodide of potassium or to mercury. Again, our patient is old, we feel that his arteries are hard, perhaps unevenly so, and we suspect either slight *cerebral hæmorrhage*, which need not be fatal, or perhaps coagulation of the blood in one or more of the cerebral arteries (*thrombosis*, they call it), and as a consequence, *white softening*, which we cannot hope to cure. Or we may detect albumen in our patient's urine, and regard the case as one of *toxæmic* spoiling of the brain. Or we gather that he has had rheumatic fever—or (whether he has had it or not) that he has now valvular cardiac disease, cognisable by the ear, and, on grounds to be explained hereafter, we set the case down as one of what is called *embolism*, and believe that a branch of one of the nutrient arteries of the brain has been shut up by a little plug of fibrin. Or, once more, we find scrofulous or cancerous disease in other parts of our patient's body, or we trace the strumous or the cancerous diathesis in his family history, and we recognise the likelihood that the head-symptoms proceed from scrofulous or cancerous *tumours* in the brain.

I attended, with Dr. Latham, a youth whose symptoms led us to believe that he had tubercular disease of the peritoneum; a very formidable complaint, which I shall more particularly describe in a future lecture. We thought it probable also, although there were no *physical signs* of pulmonary disease, that his lungs contained crude tubercles. After some time, he went down to the coast; and was there attacked with a fit of general convulsions. Up to that period he had shown no symptoms whatever indicative of organic disease within the head. On being apprised of this seizure, we expressed in a letter to the physician then attending him, our opinion that it had resulted from the presence of scrofulous tumours in the patient's brain. The convulsions returned a few days afterwards with great violence, and the boy died. It was as we had conjectured. The peritoneum was found studded with innumerable miliary tubercles: there were a few crude tubercles, of some size, around the roots of the lungs; and two large masses of the same sort in the brain. Here, you see, we were directed to a correct special diagnosis of the cerebral disease, simply by the evidence which had satisfied us that scrofulous tubercles existed in other parts of the body.

Of specific tumours the syphilitic is the only kind that we can hope to cure. For the rest there is really nothing to be done by way of their removal. We must then treat the symptoms, and seek to alleviate them as they arise. When it appears most likely, or not unlikely, that the cerebral symptoms may be the result of common inflammation, we must give the patient the chance of being benefitted by some of the remedies of inflammation; we must treat the case in this instance upon the *most favourable* supposition. The class of remedies from which most may be hoped in such equivocal cases, are local bleeding, counter irritation, and especially the cautious and regulated employment of mercury. I have, I believe, stated to you before, that I have known several obscure but threatening symptoms of brain disease clear entirely away, when the gums were made tender by mercury, and kept slightly tender for some little time. It is possible that we may sometimes do our patients harm by this mercurial treatment. We may, now and then, accelerate the arrival of death in persons whom nothing could save; but we must not be deterred from giving them this chance of being rescued from a disorder which may be susceptible of cure, but which, if unchecked, will inevitably be fatal.

LECTURE XX.

Hypertrophy of the Brain:—Atrophy. Acute Hydrocephalus: its Anatomical Characters; its Scrofulous Nature; Premonitory Signs; different Modes of Attack; Stages of the Disease; Causes.

There is a very curious morbid condition of the brain, to which I shall advert before I take up the consideration of certain cerebral diseases as they occur in *children*. The condition of which I am about to speak I was totally ignorant of till I had been for some years in practice. In the spring of 1833 I admitted a young woman, 19 years old, into the Middlesex Hospital. Her countenance was sallow, and her lips pale. She complained of pain in her chest and limbs, of great and increasing debility, of wasting, and of nightly perspirations. She had some cough, and a frequent pulse; and although no morbid sounds were audible in her lungs, I suspected that they might contain small or scattered tubercles. She had been in the hospital scarcely a week, when she had a violent fit of epilepsy; and after recovering from it, she told us, for the first time, that she was *subject* to such attacks. The convulsions recurred on the same day, and she became insensible, and remained so during the whole of the next day, and till the evening of the day after, when she died. During this period of insensibility she had many convulsive fits; the pupils of her eyes were dilated, her pulse 100, small and feeble. Leeches were applied to the temples, a blister to the neck, and afterwards to the shaven head, and other measures were used, but in vain.

When the surface of the brain was exposed by the removal of the skull-cap, and of the dura mater, it was observed that the convolutions were remarkably flattened, so that the little furrows between them were nearly effaced: and the surface of the arachnoid membrane was perfectly dry. These are not very unusual, though they are unnatural appearances. I had often seen such before: and I ventured to say that we should find some cause of strong pressure in the central part of the brain: effusion of serum into the ventricles, or a large amount of extravasated blood, or a growing tumour. Any such source of centrifugal pressure either prevents altogether the outpouring of the natural sub-arachnoid moisture, or forces it away into the spinal canal. But to my great surprise, and much to the discredit of my prophecy, we found nothing of the kind. The ventricles were even smaller than natural, and contained scarcely any moisture. The skull-cap was afterwards examined, and the bone was found to be uncommonly thick, dense, and heavy; and its inner surface, without being rough, was very irregular. I regret that, in this examination, the state of the blood-vessels of the brain, and the consistence of the cerebral matter itself, were not particularly noticed. In the record made at the time by my clinical assistant, it is merely stated that the brain was otherwise healthy. There was no disease in the lungs.

This dissection interested me much, for I had never seen, nor heard of, anything like it before. But upon looking into some modern authors, I discovered that the same phenomena had been noticed by several observers, who had very properly (as it seems to me) considered them as the result of *hypertrophy* of the brain. There is a very good memoir upon the subject, by M. Dance, published in the fifth volume of Breschet's 'Répertoire d'Anatomie': and Andral gives an account of the disease in his 'Pathologie.' It appears that Morgagni had not overlooked it, for he speaks of instances in which the brain seemed too big for its bony enclosure. When, in these cases, the skull is sawn through, the upper loose portion of bone starts up as if moved by a spring, and the edges of the bone remain widely apart. Laennec also, in Corvisart's 'Journal,' states that upon opening the bodies of persons whom he had thought affected with hydrocephalus, he had been surprised at finding a very small quantity only of fluid in the ventricles, while the convolutions on the surface of the brain were strangely flattened; proving that the cerebral mass had undergone strong compression, which could only have arisen from its preternatural volume, and undue nutrition.

Besides the characters I have mentioned, the hypertrophied and compressed brain is firmer and tougher than natural; it contains but little red blood; and sections of it are seen to be unusually dry and pale.

It is stated by Dr. West that enlargement of the wrists and ankles shows a connection between hypertrophy of the brain and rickets. In most of the cases recorded by authors, the patients had suffered epileptic fits, or rather paroxysms of convulsions; and in some of them the convulsions terminated in paralysis. In some instances, the intellectual faculties have been observed to become dull and obtuse; and in some the end has been idiotcy. Many of the patients were subject to severe headaches. All these symptoms are common to various cerebral complaints. The diagnosis of this rare disorder can be little better than conjectural; and its treatment we have still to seek.

Andral remarks, what is very true, that hypertrophy of the brain, *i.e.*, an undue and disproportionate development of that organ, may, and does happen, without giving rise to any morbid phenomena at all. But, in such instances, the *brain-case* is equally enlarged in capacity; so that no squeezing of the cerebral mass results from its own preternatural growth. It is only when the brain increases faster than the bony sphere which contains it, that the hypertrophy becomes a disease. In my patient there was also, in one sense, hypertrophy of the skull; the bone was considerably thicker, and more compact and heavy, than is usual; but the capacity of the cavity had not undergone a proportional augmentation: nay, it might, for anything I know, be diminished in consequence of the increased thickness of the bone; the case may have been one of concentric hypertrophy of the bone, without any fault of the brain itself: but what makes this the less probable is, that in other cases the skull has been found of the ordinary thickness and density; but too small for its contents.

It is of some importance for you to be aware that the brain, and its case, may be extravagantly developed without there being any disease, or any symptoms of disease. M. Scoutetten gives an instance of this which he observed in a child five years old. Its head was as large as that of a well-grown adult person. The skull was from a line and a half to two lines in thickness. The dura mater adhered firmly to the bone, and the cerebral mass exactly filled up the cranial cavity. The superior and posterior part of the brain was developed beyond measure, so that to reach the ventricles it was necessary to make an incision nearly three inches in depth. There was nothing unusual to be remarked in any of the cerebral functions of this child; it was just like other children of the same age in respect of intellect. It died of acute inflammation of the bowels.

The late Dr. Sweatman met with just such another child a few years ago: and I refer to his description of it the rather, because cases that occur near home are always more interesting, and satisfactory, than those which we merely read of in foreign authors. Dr. Sweatman had never read of anything of the kind: but in August, 1834, a little boy, two years old, was brought to him on account of the size of his head. It had been gradually increasing from the age of six months, till it had become so large as by its weight to prevent the child from continuing long in the upright posture. The boy was active and lively, though thin. He never had had any fit or convulsions; but occasionally seemed uneasy, and then would relieve himself by laying his head upon a chair. He had never squinted, nor was he subject to drowsiness, or startings during sleep; and his pupils contracted naturally. His appetite was good, and all the animal functions were properly performed. Dr. Sweatman got Mr. Herbert Mayo to see the child with him: they both set it down as a case of hydrocephalus, but agreed in thinking that in the absence of symptoms it would be wrong to risk disturbing his digestive organs by active medicines. In the early part of 1835 the child died of inflammation of the chest, and Dr. Sweatman and Mr. Mayo examined the head. I here show you a cast of it. It measured, from ear to ear, over the vertex, twelve inches; from the superciliary ridges to the occipital, thirteen inches; and in circumference twenty-one inches. The anterior fontanelle, which was quite flat, measured across its opposite angles two inches and a quarter by one and a half; the posterior fontanelle was completely closed, as was the frontal suture. There was no absorption of bone at any part; on the contrary, it was becoming thicker. The dura mater adhered with great firmness to the skull; and a layer of false membrane, as big as a crown-piece, was found upon its upper and anterior part. Beneath the arachnoid at that part there was slight jelly-like effusion. In all other respects the organ was sound. The convolutions were perfectly distinct, and retained their proper rounded shape. All the ventricles were found empty, and not dilated. The surfaces, however, of the medullary matter, exposed by repeated sections, presented very unusual vascularity.

The lesson we learn from cases of this kind is, that we are not to regard every child that has a very large head as a hydrocephalic child: and especially that we are not to inflict upon such a child a course of active remedies, unless some morbid symptoms appear. The *nimia cura Medici* may in these, as in many other cases, destroy health; produce disease where none existed before.

Having told you what I know of *hypertrophy* of the brain, it is proper that I should say a word or two respecting the opposite condition; of *atrophy* of the cerebral mass. There are two forms of this affection: one is congenital, and results from imperfect development, or from an arrest of development, of the brain in its fœtal state. In the other the change appears to take place in consequence of disease, either in the membranes of the brain, or perhaps in its arteries; though the effect of disease in the arteries is usually softening, which *is* a species of atrophy. But in the atrophy to which I am now alluding, the *volume* of the atrophied part is diminished, not its *consistence.* And the diminution of size may extend only to a few convolutions: or it may be most manifest in the interior of the organ; in the optic thalami and corpora striata for example. There is still another alteration to which some have applied the term atrophy, though improperly, I think: I allude to those cases, which I shall speak of more particularly soon, in which the form and disposition of the cerebral substance is altered, the convolutions being unfolded, and the nervous matter spread out by a large collection of fluid in the interior cavities of the brain, constituting the disease called *chronic hydrocephalus.* I have not much to say upon what may be styled atrophy *proper* of the brain: that it will give rise to symptoms we cannot doubt, but that it shows itself by any peculiar or characteristic symptoms is what I have not discovered.

I shall content myself, on this subject, with showing you Cruveilhier's representation of a strongly pronounced example of atrophy of the entire cerebrum on one side. The drawing from which this engraving was made, was painted from the body of a patient who died in the Hôtel-Dieu, dropsical in consequence of disease of the heart. He was forty-two years old. When you look at the engraving you will perceive that the left side of the cerebrum is diminutive compared with the right. It filled up, however, a larger space than it appears to do in the plate, for the lateral ventricle on that side was distended by a quantity of serous fluid, which ran out when the ventricle was punctured; and then the surface of that side of the brain sank down, and collapsed. Still the convolutions on that side, and all the dimensions, are remarkably less than on the other. The anterior lobe projects half an inch further on the right than on the left side. The frontal bone, you will observe, is much thicker; twice as thick on the atrophied as on the natural side; and the frontal sinus is very wide and open. The internal parts of the brain are all diminished in proportion. There was a large quantity of serous liquid filling and distending the subarachnoid areolar tissue. The nervous matter was whiter and harder on the atrophied side. One very curious thing is, that the *left* lobe of the *cerebellum* was the bigger of the two; but there was no such marked difference between them as between the two sides of the cerebrum.

Now the patient in whom this singular disproportion between the two sides of his brain was met with, had been incompletely hemiplegic, as long as he could recollect, on the right side; and the imperfectly palsied limbs were shrunk and withered, and the fingers of the hand contracted. Yet he had managed to walk about with the help of a stick; and there was nothing remarkable, one way or the other, in the state of his intellectual faculties.

The same condition has been seen on both sides of the brain: the organ itself existing in miniature as it were, and lying at the lower part of the vaulted cavity of the cranium: the intermediate space being filled up with water. This condition of the encephalon is accompanied by idiotcy. In long-standing cases of this description you must not suppose that the nervous matter has been compressed into a smaller compass by the effused fluid; but that the fluid has been poured out to fill that part of the skull which is empty of brain, and which must be filled with something.

I proceed in the next place to the consideration of that disease to which the name of *acute hydrocephalus* has been given. By that term I desire to signify *inflammation of the brain*, as it frequently occurs in *children*, and especially in *scrofulous* children. The inflammatory character of the disorder, though not always very clearly expressed in its symptoms, is sufficiently attested, in many of the fatal cases, by the changes discovered within the cranium.

I made some observations, in the last lecture, respecting the nomenclature of diseases, and said something in defence of the term delirium tremens. Now it must be confessed that the complaint we are about to consider was unfortunately named, when it was called hydrocephalus. I repeat that it matters not at all how we denominate a disease, provided that its title does not involve any erroneous notion of its *nature*. I think hydrocephalus a bad name, because it reminds us of one circumstance only of the malady, viz., the serous effusion, which so far from being the *cause*, or the *essence*, is only a *frequent effect* of the disease; nay, it is no uncommon effect of other morbid conditions also, besides inflammation. But hydrocephalus, or water in the head, is an appellation so established, both among ourselves and with the public, that I cannot venture to propose any change.

In early life, simple encephalitis, except perhaps from injuries to the head, is not often seen; and when inflammation of the brain does befall a child of healthy frame and constitution, it resembles in its general course and features the same complaint, occurring in the adult patient. What we call acute hydrocephalus is almost always, I believe, associated with the scrofulous diathesis—almost always an instance of scrofulous disease. Allowing for diversities of structure and function, acute hydrocephalus, phthisis pulmonalis, and tabes mesenterica, may respectively be regarded as the ordinary results of the same mordid tendency, manifesting itself in the three great cavities of the body, the cranium, the thorax, and the abdomen. It is surely a most significant fact, as recorded by Dr. West, that 'in twenty out of twenty-seven instances of hydrocephalus, in which the health of the relatives was made the subject of special enquiry, it was ascertained that either the father, mother, aunt, or uncle had died of phthisis.'

If you have recourse to books for a knowledge of this disorder, you will meet with endless discussions, and most perplexing differences of opinion, respecting its true pathology, and its proper management. To check, or to verify, by individual observation, the notions received from indiscriminate reading, requires peculiar opportunities, such as few enjoy save those who are largely engaged in the practice of midwifery, and familiar, as the natural consequence of that practice, with the diseases of children.. By far the best exposition that I have seen of what is known upon the subject, is given by Dr. West, in his published 'Lectures on the Diseases of Infancy and Childhood.' Upon a careful selection of accredited facts from various writers who have preceded him, Dr. West has cast the clear light of his own well-used and large experience.

In the first place, acute hydrocephalus is an *inflammatory* disease.

We are led inevitably to this conclusion by its *symptoms*, which much resemble those that occur where undoubted inflammation has arisen from injuries of the head: by the *appearances seen on dissection*, which are always such as inflammation might have produced, as softening, and the effusion of serous fluid; and frequently such as nothing but inflammation could have produced, as suppuration, and the formation of adventitious membranes: and lastly, by the unequivocal relief often afforded by the abstraction of blood, and by other evacuations.

Let us take the least equivocal of these three kinds of evidence—the morbid appearances presented after death. What are they?

In some cases we find traces of inflammation of the membranes of the brain; a firm attachment of the skull-cap to the dura mater; occasionally some adhesion of the opposite surfaces of the arachnoid to each other. Sometimes there is an effusion of serous fluid beneath the arachnoid, in the meshes of the pia mater, and especially in the depressions between the convolutions. You would suppose, upon looking at this collected fluid through the arachnoid, that it had the consistence of jelly: but it is not so. If you divide the arachnoid by means of a sharp scalpel, a perfectly limpid fluid makes its escape. More commonly the arachnoid is drier than is natural, has a dull lack-lustre aspect, and feels sticky to the touch. Not unfrequently there are layers of coagulable lymph interspersed between the arachnoid and pia mater: this is a most unquestionable evidence of foregone inflammation; and it is most often met with in the strongly marked cases. When portions of the cerebral mass are removed by slicing it, a great number of red points are frequently to be observed, speckling the cut surface. I mention this appearance just to say that, to the best of my belief, it does not warrant any conclusion in regard to the state of the brain before death. We find these red spots numerous in many cases, where there had been no cerebral affection manifested during life; and they are not always to be seen when we are certain that there was inflammation. With respect to the nervous matter itself, it is said to be sometimes softer throughout than natural, and occasionally it has been found infiltered, as it were, with serous fluid; *wet*, and *so* rendered soft. Gölis describes an instance of this kind, in which, he says, the fluid could be expressed from the cerebral substance as from a sponge.

A more common and characteristic change is *softening of the central parts of the brain, with an effusion of serous fluid into the ventricles.* Generally the effused fluid is thin and watery; serosity rather than serum. It contains less animal matter, perhaps, than any other animal production. Dr. Bostock found that of 100 parts, 98·6 consisted of water, 1 part of salt, and

0·4 only of animal matter. It is not, therefore, in common, coagulable by heat. The quantity effused is uncertain; speaking generally, it varies from two to six ounces.

In fifty-nine out of sixty-one cases, in which death had taken place under the symptoms of acute hydrocephalus, Dr. West found an appreciable quantity of fluid in the ventricles; and in forty-nine of these cases the quantity was considerable, amounting to several ounces.

The effused fluid is not always, however, clear and limpid: sometimes it is turbid, like whey, or even puriform, with flocculent shreds floating in it. These have been considered as flakes of coagulable lymph; but I question whether, in many cases, they are not mere fragments of the softened and broken down materials in the neighbourhood; for the septum lucidum, the fornix, and other parts forming the walls of the ventricles, are very commonly found to be soft and pulpy, or entirely disorganised. The septum is perforated perhaps by a ragged irregular opening, the softened portion having fallen out: the fornix has lost its consistence, and often its figure, or falls asunder when the most gentle attempt is made to raise it. It was Dr. Abercrombie's opinion, not only that this softness is the result of inflammation, but that in very many cases of acute hydrocephalus, inflammation of these central white parts constitutes the essence of the disease. He relates two striking examples, in which this softened condition of the septum lucidum, fornix, and corpus callosum, without any effusion of serum, or any other morbid appearance, was found after death preceded by symptoms which are usually considered to indicate acute hydrocephalus.

It has indeed been thought that the softening of these central parts may sometimes be the consequence of their maceration in the effused fluid. But this notion is disproved by the fact that the ventricles are often found full of fluid when there is no defect of consistence in the cerebral substance forming their walls. Among fifty-nine cases, carefully noted by Dr. West, there were twenty-two in which no central softening existed, although the ventricles contained fluid in every case but one. He refers to the statements of a German, Herrich, who found central softening of the brain in forty-seven only out of seventy-one instances, in which the ventricles contained from three to eleven ounces of serum. Finally, M. Rokitansky has ascertained, by direct experiment, that slices of cerebral matter may be soaked, for hours, in serum, without undergoing any change of consistence.

In most instances the membrane lining the ventricles exhibits, even to the naked eye, distinct traces of inflammatory action; is seen to be vascular, opaque, to have lost its natural polish, and even to have become sensibly thickened, and granular.

Dr. West gives an interesting account of the inflammatory changes presented by the superficial investing membranes. Upon the convexity of the brain those alterations are often comparatively slight; while at its base they are almost always conspicuous. In fifty-six out of sixty-one fatal cases he found the membranes of the base to be the seat of disease, more or less extensive, and always exceeding that which existed at the vertex.

'The least considerable (he says) of the morbid changes in the membranes at the base of the brain consists in a milky or opaline condition of the arachnoid and pia mater, but chiefly of the former, sometimes extending over the whole lower surface of the cerebrum, but seldom being equally apparent in that part of the membrane which invests the cerebellum. But, besides this opacity, we usually observe much more distinct evidence of inflammatory action in the effusion of yellow lymph beneath the arachnoid. This is generally found about the olfactory nerves, which are often completely imbedded in it; while a similar effusion extending across the longitudinal fissure unites the two hemispheres of the brain together. A deposit of the same kind likewise reaches up the fissure of Sylvius in many cases, and connects the anterior and middle lobes of the brain with each other; or if poured out in less abundance, it may be seen running up in narrow yellow lines by the side of the vessels as they pass from the base of the brain towards its convexity. It is in the neighbourhood of the pons Varolii, however, and about the optic nerves, that the most remarkable alterations are met with. The opacity of the arachnoid is here particularly evident, while the subjacent pia mater is opaque, much thickened, and often infiltrated with a peculiar semi-transparent gelatinous matter, sometimes of a dirty yellowish-green colour. This matter is sometimes so abundant as perfectly to conceal the third and fourth nerves, and at the same time to invest the optic nerves with a coating two or three lines in thickness; though, on its being dissected off, the substance of the nerves beneath appears quite healthy. When this morbid condition exists in a very considerable degree, it extends beyond the pons, and involves the membranes covering the medulla oblongata, especially at its anterior surface.'

Enough, I think, has been said, to convince you of the inflammatory character of this fearful malady. But, secondly, acute hydrocephalus is a *tubercular* disease.

Occasionally, scrofulous tubercles, of considerable magnitude, are discovered in the substance of the brain; and it is probable that these would have been *more* frequently met with, if they had always been carefully looked for. They consist of a cheesy kind of matter, like that of large tubercles in the lungs.

Much more commonly the tubercular deposit manifests itself in the shape of small granules, scattered, many or few of them, upon or between the membranes of the brain. This fact has not hitherto received, in this country, that degree of notice which its great importance deserves. It has engaged the attention, for some years past, of several of the French physicians. The following clear summary is given by Dr. West of the result of their observations.

'The conclusion to which we are led by their careful investigation of the subject is, that the peculiar granular appearance which various parts of the membranes of the brain often present in this disease, is not due to inflammation, as was once supposed, but is occasioned by the presence of minute tubercular deposits. These deposits often assume the form of minute flattened spherical bodies, of the size of a small pin's head, or smaller, and either of a yellowish colour, and rather friable under pressure, or grayish, semi-transparent, and resistant, almost exactly resembling the gray granulations which are sometimes seen in the lungs or pleuræ of phthisical subjects. They are likewise sometimes met with in what would seem to be an earlier stage, when they appear like small opaque spots, of a dead white colour, much smaller than a pin's head, and communicating no perceptible roughness to the membrane. This appearance is often observed in the arachnoid covering the cerebellum, and those parts of the base of the brain where the arachnoid is stretched across from one portion of the organ to another. The flattened yellowish bodies are more frequently seen at the convexity of the brain, and on either side of the hemispheres. They generally follow the course of the vessels that ramify in the pia mater, and accordingly occupy the sulci between the convolutions much oftener than their summit. The firm gray bodies are mostly seen about the pons, or imbedded in the pia mater in the neighbourhood of the optic nerves, or projecting from the surface of the membranes that cover the medulla oblongata. They are also often deposited in the arachnoid lining the occipital bone, and are then sometimes collected in considerable numbers around the foramen magnum. These bodies, sometimes of a gray, at other times of a yellow colour, are likewise met with, though less frequently, in the substance of the velum interpositum, or imbedded in the choroid plexuses; and in both of these situations they are sometimes very abundant.'

'These bodies, however, do not always retain the appearance of distinct granules, but sometimes on separating two folds of the arachnoid, which had seemed to be glued together by an effusion of yellow lymph or concrete pus, we find that the matter which formed these adhesions is not homogeneous, but that it consists of an aggregation of minute granular bodies, connected together by the lymph or pus in which they are imbedded. This appearance is often met with at the convexity of the brain, and close to the longitudinal fissure, and rather more towards its posterior than its anterior part; a strip of this yellow matter, half an inch long by two or three lines broad, connecting together the two hemispheres of the brain, or the two surfaces of the arachnoid. Sometimes two or three deposits of this kind are observed at the convex surface of the brain, but they are generally more extensive at the base of the organ, where they occupy the longitudinal fissure and the fissure of Sylvius, and frequently connect opposite surfaces of the brain so closely together as to render their separation impossible without injury to its substance.'

The reasons which have convinced Dr. West of the tubercular nature of these deposits are—

'1st. That they are always associated with tubercle elsewhere.

'2nd. That their abundance is not in proportion to the amount of inflammatory mischief.

'3rd. That they are sometimes met with in cases where no head symptoms were observed during life, and unconnected with any sign of inflammation discovered after death :—and

'4th. That their chemical composition and their microscopic structure are identical with those of tubercle in other organs of the body.'

In this disorder the tubercular deposit may either provoke by its presence the supervening inflammation, or render the brain and its membranes more liable to suffer inflammation from other influences: in other words, the tubercles are probably sometimes the sole exciting cause of the inflammatory mischief, sometimes merely a strong predisposing cause. We see, in the changes which lie beyond and precede the inflammation, too plain a reason for the generally hopeless character of the resulting malady.

After what I have already stated in respect of simple inflammation of the brain in adults, you will be prepared to hear that acute hydrocephalus (remember, I restrict that term to the same inflammatory malady as it occurs in strumous children)—I say you will not be surprised to learn that acute hydrocephalus furnishes a great variety of symptoms; and many variations in the mode of their coming on, and in their combination and succession.

It is obviously of the greatest importance to recognise acute hydrocephalus in its *earliest* stages; and even to look out for indications of its approach. I shall, therefore, describe those changes in the state of the young patient, which have been found to be, in many cases, premonitory that the disease was impending. But such symptoms are by no means always followed by acute hydrocephalus; nor is acute hydrocephalus always preceded by such symptoms. Still, when they do occur, they should put us upon our guard.

The *precursory symptoms* to which I allude consist chiefly in a morbid state of the nutritive functions. The child loses his appetite, or his appetite becomes capricious; he sometimes appears to dislike his food, and sometimes devours it voraciously; his tongue is foul, his breath offensive, his belly enlarges, and sometimes is tender, while his limbs waste; his bowels are torpid, and the evacuations from them unnatural; the stools are pale and contain but little bile, or they are dark with vitiated bile, fœtid, sour-smelling, slimy, or scybalous; and the child loses his former healthy aspect, becomes paler and thinner. Even already there are obscurer indications of derangement in the cerebral functions; the child is heavy, taciturn, languid, slow, dejected; his customary spirit and activity are gone; he grows fretful and irritable, or drowsy and listless, and is manifestly uneasy; and sometimes he manifests a little unsteadiness and tottering in his gait.

In some children, when the disorder is at hand, or incipient, an unnatural wakefulness is often observable: or restless sleep—attended by grinding of the teeth, or moaning—is interrupted by sudden awakings in distress and alarm. A frequent sudden cry or scream, a clenching of the little fists, and a turning in of the thumb towards the palm of the hand, give warning also of the approaching malady.

Now when this sort of alteration is observed in a child who has any hereditary title to scrofula, or bears the marks of the strumous, or of the tubercular, *diathesis*, or is even a precocious and particularly clever child, and still more if he present any other indication of strumous *disease*, there will be much reason to apprehend that mischief is brewing within his head. I advert to these tokens of scrofula, because the cerebral inflammation is, in every case probably, of a scrofulous character. But there is this peculiarity in it, which distinguishes it from scrofulous inflammation in most other parts, viz., that as it occurs in an organ of very delicate structure, and one which is essential to life, its progress is more rapid, and it is more necessary to treat the disease promptly.

It has been made a question whether the derangement of the digestive organs that has just been described is or is not the immediate exciting *cause* of the affection of the brain; or whether both the abdominal and cerebral disorder are not common and concurrent effects of the same cause. You will not have much difficulty in replying to that question. It is said that the stomach and bowels are more in the way of being acted upon by injurious influences than the brain, and that, therefore, the inflammatory quality of the complaint may be supposed often to arise from their derangement; and great good, it is alleged, is done, the disease of the brain is often *prevented*, by remedying the disordered condition of the stomach and bowels. On the other hand, it may be stated that a similar derangement of the digestive organs often comes on and lasts long in children, without leading to hydrocephalus; and hydrocephalus often attacks a child in whom no such symptoms of abdominal disease have appeared. We can never be certain, therefore, that hydrocephalus has been prevented, in any given case, by remedies addressed to the digestive organs. I cannot think the question is one of much practical importance. Whether the disturbances of the nutritive functions *cause* the brain disease, or merely *indicate* it, they are equally valuable in directing our attention to the head.

In these little patients any source of irritation seems to act as an *exciting* cause: surgical operations, which are sometimes necessary at that tender age—falls or injuries of any kind—painful dentition.

There are, at least, three several ways in which this disease may make its attacks; and with these it is proper that you should be acquainted.

In the first place, it may come on *gradually*; after such symptoms as have already been spoken of as being premonitory. Probably this is the way in which it most frequently commences. After a period, of uncertain duration, in which the child has complained of occasional pains in the belly and head, and signs of derangement of the stomach and bowels have been present, the pain in the head begins to be more severe and to recur more frequently. It is not mere headache, but generally a sharp shooting pain, recurring at intervals; sometimes it affects one side of the head more than the other: the little patients wake and shriek out with the pain, and this in children is a very characteristic symptom. As coma comes on, this shrieking gives place to an habitual moaning, which is scarcely less characteristic. Very often in the beginning of the disease there are pain and stiffness at the back of the neck; sometimes there is much pain of the limbs in the early periods, and in some children extreme tenderness of the scalp, so that they cannot endure to have the head shaved. The pain of the head becomes complicated with vomiting, and both these symptoms are aggravated by motion. Very often nausea is excited by the erect posture, and the patient wishes to lie down. The child sighs frequently, and looks grave or sad; his eyes are pained by a strong light, so that he knits his brows. The pulse becomes rapid, and the disturbance and irregularity in the abdominal functions increase. This stage of the complaint may last several days, the child becoming daily more weak and more peevish, and looking more and more ill.

In the second form of attack there are no premonitory symptoms; or they occur for a very short while only, before the disease sets in suddenly and violently, with acute pain in the head and high fever; or with convulsions: the face is flushed, the eyes are brilliant; there is intolerance of light and of sound, and there are pain and tenderness of the abdomen. When the disease commences in this manner, there may be some reason to hope that it is simple encephalitis; cerebral inflammation unaccompanied with tubercular deposit. The symptoms are not unlike those which sometimes mark the onset of continued fever. You may find these varieties described in Dr. Cheyne's excellent treatise on this disorder. 'We are led to suspect,' he says, 'some deeply-seated evil from the frantic screams and complaints of the head and belly, alternating with stupor, or rather lowness, and unwillingness to be roused; and we are struck with the great irritability of the stomach, which exists in a degree beyond what we generally find it in the fevers of this country; retching and vomiting being brought on by a change of posture, and certainly by every attempt to sit up in bed; and the disordered state of the bowels, which attends this irritability of the stomach, is also remarkable: and when at any time the child has a little respite from the violence of these symptoms, we find our suspicions confirmed by his looks; for when the features do not express pain or terror, there is not unfrequently a vacancy of look, the eyes being *set*, with an expression of dejection which is peculiar to certain diseases of the brain.' The mode of attack which has now been described, although the most regular in its progress, is not so common as the first, nor as the third, which I have yet to mention. The *third* way in which the disease makes its advances is very insidious; the head symptoms supervene upon the subsidence of some other malady: presently after the disappearance of an eruption from the scalp; during the decline of scarlet fever, small-pox, hooping-cough, or some inflammatory or febrile complaint; and even after painful dentition. In these cases the early symptoms are often but slightly marked, or do not take place at all; the sudden occurrence of convulsions or paralysis affording the first evidence that the brain is implicated. This is the most dangerous form of hydrocephalus. It has received the expressive title of *waterstroke*. Dr. West doubts the propriety of counting these cases as instances of true tubercular hydrocephalus.

In whatever way the disease makes its invasion, it is apt to be attended with many and variable symptoms; and different observers, with the view of facilitating their description of the disease, and of making it more intelligible and more easily remembered, have divided the symptoms into groups, and considered each group as characteristic of a particular *stage* of the malady. But they have not all done this in the same way. It may be of use, however, to inform you of the different classifications which have thus been proposed. Dr. Whytt, who was almost the first person in this country who wrote upon this disease (I believe Dr. Paisley, of Glasgow, was *the* first: you may see his paper in the third volume of the 'Edinburgh Medical Essays'), Dr. Whytt, I say, whose description is an extremely good one, took the *pulse*—which undergoes very remarkable variations in the course of the disorder—as the ground of his division. He makes three stages of it therefore; the first, in which the pulse is frequent; the second, in which it is slow and irregular; and the third, in which it again becomes frequent and feeble. These successive fluctuations in the pulse are to be noticed in very many cases. Dr. Gölis, again, an eminent German writer on hydrocephalus, whose little work was translated by the late Dr. Gooch, as being the best book on the subject that he was acquainted with, makes four stages, according to what he believes to be the condition of the *brain* in each. First, he has the period of *turgescence*, which corresponds with that period in which the premonitory symptoms occur; secondly, the period of *inflammation*; thirdly, the period of *effusion*; fourthly, the period of *palsy*. The two last would appear to be almost identically the same. Dr. Cheyne makes three stages; which he finds marked, not like Dr. Whytt, by the state of the circulation, but by the state of the nervous system. Thus he calls the first the period of *increased sensibility*, when every stimulus produces an inordinate impression. In the second stage, that of *diminished* sensibility, the child is not easily roused, his pupil is dilated, and his pulse slow; he is lethargic, with obstinately costive bowels. The third stage with him is that of *palsy and convulsions*, in which there are squinting, rolling of the head, stupor, convulsions, with a rapid thready pulse.

Cases often occur, however, that baffle all these attempts at classification. Convulsions, instead of being among the *last*, are not seldom among the very *first* symptoms. The pulse is sometimes remarkably *slow* at the *outset*; sometimes *frequent through the whole disease*; and sometimes *perfectly natural.*

I do not make these statements to magnify the difficulty of distinguishing the disease; for the diagnosis is really not so difficult as it has sometimes been represented; but to show you that you must not trust to any succession of symptoms, still less to any one symptom, as being pathognomonic.

The symptoms that occur during the first stage are very variable, as you may suppose from what I have said of the different modes in which the disease is apt to set in. Those that are most constant are, pain of the head, severe shooting pain I say it seems to be, for the child puts its hand there, and cries out frequently 'Oh! my head;' restlessness; inability to sit up; very disturbed sleep, with grinding of the teeth, and from this sleep the child often starts apparently in terror, and with a scream. The head is hot externally; the little patient is annoyed by light and by noise; the pupils are most commonly contracted during this stage; the child is unwilling to be disturbed, and, therefore, does not reply readily to questions; but the replies, when made, are correct and rational. This stage is marked also by vomiting, a total loss of appetite, a white tongue, offensive breath, costive bowels, unnatural stools, green often, or black, like tar, scanty and high-coloured urine. Dr. Gölis says that the abdomen, which has been tumid and tender perhaps, sinks down and becomes flat, without any increased excretion by stool; and that this is a very characteristic symptom. The intestinal gases disappear. The pulse in this stage is frequent and sharp. In short, the symptoms are such (in general) as indicate very plainly that inflammatory action is going on within the head. Now the symptoms that characterise this first stage of the complaint sometimes rapidly pass into those which belong to the second. They may not be present for more than a few hours; or they may last a day or two, or several days; it is very seldom, I believe, that they continue longer than a week. The period answers, in the general character of the symptoms, to the period of *excitement* in encephalitis, which I repeat is very much the same disease, modified by its occurrence in the adult and otherwise healthy subject.

So also the *second stage* of acute hydrocephalus corresponds, in its general features, with the period of *collapse* in encephalitis. The pulse becomes irregular, extremely variable and fluctuating, and often *slow*: it is easily accelerated, however, by the smallest exertion—by taking the child out of bed, or even raising him into a sitting posture. With this slowness of the pulse come on a diminution of sensibility, and general heaviness and stupor; the pupils dilate, the light is no longer troublesome, the vision is imperfect, often it is doubtful whether the child sees at all. If the eye be closely examined and watched, the degree of light remaining the same, the size of the pupil will frequently be seen to fluctuate, or oscillate, till at last it is wide open and immoveable. While this goes on, squinting takes place, and double vision when the child can yet see anything. One or both eyes are turned in, or more rarely outwards. Noises do not now disturb or irritate the child—who lies on his back, with eyes half closed, in a state of drowsiness or stupor, which is occasionally interrupted by some cry or exclamation expressive of pain. Convulsions frequently occur, but not uniformly; slight and partial spasmodic twitchings; or general and long-continued convulsions; paralysis; sometimes hemiplegia. The vomiting generally ceases. The urine and stools are passed unconsciously. Sometimes the child, with feeble and tremulous hands, is incessantly picking his lips, or boring his fingers into his ears or nostrils.

This stage may last a week or two. And what is remarkable, it is often attended with remissions, sometimes sudden and sometimes gradual—deceitful appearances of amendment, and even of convalescence. The child regains the use of its senses; recognises again its attendants; appears to its anxious parents to be recovering;—but in a day or two it relapses into a state of deeper coma than before. And these fallacious symptoms of improvement may occur more than once.

The third stage does not differ materially in the character of the symptoms that accompany it, from the second, except that the pulse again becomes frequent, nay, uncommonly rapid; beating sometimes 200 strokes in the minute, so that you can scarcely count it. Dr. Whytt, in one instance, reckoned more than 210 pulsations. The child rolls its head perpetually from side to side; moans continually; waves its hands in the air, or one hand, the other frequently being palsied; sometimes there is paralysis of one side, and convulsive twitchings of the other. The circulation is very unequal; one part of the body will be found hot and dry, and another covered with a cold sweat; the cheeks are alternately pale and flushed; the child is raving, or insensible; the rapid pulse gets more and more weak; and at length the patient expires. In many instances death takes place in the midst of a strong convulsion. This last period is of very uncertain duration; it may be over in a few hours, or it may last a fortnight.

For my own part, I conceive that for all practical purposes it would be quite enough to make two stages only of this disease. In the first, the symptoms are those of inflammation of the parts within the cranium, or of some of those parts; in the second, we have the symptoms that result from the consequences and products of the inflammation, from softening, and from the effusion of lymph or of serum. And frequently these sets of symptoms are, in some respects, common to both these causes; and more frequently still the causes coexist, effusion taking place, yet the inflammation going on. And we may understand how the whole collection of symptoms may vary and fluctuate, and assume an uncertain character, according as the inflammatory process has ceased, or is still in progress; according as it exists alone, or is mingled with the further source of cerebral disturbance that is furnished by its own events; and according as the inflammation may have come to an end, while its events remain behind, and declare their presence by appropriate signs in proportion to their place, their extent, and their various kinds and combinations.

The disorder with which acute hydrocephalus, in its commencement, may be most readily confounded, is the remittent fever of childhood. I borrow from Dr. West the criteria which help us to discriminate between these two complaints.

The vomiting, which is so grave and so frequent a symptom of approaching hydrocephalus, is often absent in remittent fever, even at its onset; or if present, it soon ceases, and is not succeeded by that abiding nausea which is frequent in hydrocephalus. In remittent fever, the bowels are often relaxed from the very first, or speedily become so; and the evacuations present no resemblance to the scanty, dark, or mud-coloured stools which are voided in hydrocephalus, but are usually fœcal, watery, and of a lightish colour. Tenderness of the abdomen is nearly constant in remittent fever, and is greater in the iliac regions than elsewhere, and gas can always be felt in the intestines. The tongue is not moist as in hydrocephalus, and is seldom much loaded, but has only a thin coating of yellow fur in the centre and towards the root, while it is very red at the tip and edges, and becomes dry at an early stage of the disease. In hydrocephalus there is frequently a great distaste for drink as well as for food, while although the appetite is lost in cases of remittent fever, yet the patients have a strong desire for drink, especially for cold drink, to quench the urgent thirst. The heat of skin in remittent fever is extremely pungent and greater than in hydrocephalus, in which, although there is marked dryness of the surface, yet the temperature is seldom much increased. The pulse in remittent fever is much quicker than in hydrocephalus, continues quick throughout, and never becomes unequal or irregular, while its frequency is in direct proportion to the elevation of the temperature of the skin. In remittent fever the child makes few complaints about its head, but delirium is of early occurrence, especially at night; in hydrocephalus, on the contrary, true delirium hardly ever occurs till an advanced period of the disease, and is sometimes absent altogether. In remittent fever, as its name implies, there are distinct remissions and exacerbations of the symptoms, the patient getting better towards morning, and worse again as night approaches; while, though there are many fluctuations in the course of hydrocephalus, yet we observe no *definite* periods, at which the symptoms invariably remit, or are increased in severity.

It may further aid the diagnosis to remember the facts, that remittent fever is very rare at an earlier age than five years, and is scarcely ever met with in children under three; while at least the half of all cases of acute hydrocephalus occur in children who have not completed their fifth year.

I may here tell you, by anticipation, that this remittent fever of childhood is, in most, if not in all cases, nothing else than what, when occurring in adults, is called typhoid or enteric fever. The appearance of certain characteristic rose spots would certify the diagnosis, but they are not always present in young children.

You will find a good deal said by some writers on this disease, of morbid appearances found in other parts besides the brain, and especially in the abdominal organs—enlargements of the liver, or spleen; inflammation of their peritoneal covering. I believe that careful investigation would always detect tubercular deposit, in greater or less quantity, in various organs: in the lungs and bronchial glands, in the glands of the mesentery, and in the mucous follicles of the intestines. Sometimes there is tubercular ulceration of the bowels, which may produce diarrhœa, and so far tend to perplex the diagnosis. One remarkable change is said to be common, viz., intus-susception of the small intestines. This probably takes place a short time only before death, and appears to be the result of spasmodic or irregular movements of the bowels, analogous to those which are observed in the voluntary muscles. The intus-suscepted portions are easily pulled out, and show no marks of inflammation.

Many persons, as I have already hinted, lay great stress, when discussing the pathology of acute hydrocephalus, upon the previous unhealthy state of the nutritive apparatus. They hold that the primary disease—the *fons et origo mali*—lies in the stomach, or bowels, or liver; and that the brain affection is secondary, and caused by sympathy with these distant parts: and this opinion they fortify by referring to the frequency of organic disease, met with after death, in the abdominal viscera. In accordance with these views of its origin, they propose to cure hydrocephalus, by redressing the faulty condition of the digestive organs.

Now this, in my judgment, is not only an erroneous, but an unsafe doctrine: for it tends to divert our attention from the head, and to misdirect the treatment. The grand predisposing cause of acute hydrocephalus is certainly the scrofulous diathesis, and this is why we see the complaint run so often in families: so that one child having died of that disorder affords much ground for apprehending that others belonging to the same family may become victims to it. The constitutional tendency is hereditary, and children born with it are liable and likely to have strumous disease set up in various organs at once, or perhaps in succession: not, however, a succession of cause and effect, but of common relation to one pervading disposition. We need not be surprised that scrofulous inflammation should affect the brain and abdomen at the same time. When we find obvious organic disease of the brain, scrofulous tubercles for instance, which must have been antecedent to the hydrocephalus, it would be just as absurd to look to the abdomen for the cause of the hydrocephalus, as it would be to seek in the brain for an explanation of the cause of jaundice or of dysentery, when the liver or the colon were known to be diseased.

I do not mean to assert that the morbid conditions of the brain and of the abdomen are perfectly independent each of the other. The vomiting that is so constant a feature of acute hydrocephalus, the constipation that is so common a consequence of head affections, afford familiar evidence of the influence which cerebral disorders may exercise upon the abdominal functions. Conversely, any disease in other parts of the body may react injuriously upon the brain, and may sometimes be regarded as an exciting cause of disease in that organ.

The period of life is also a strong predisposing circumstance; acute hydrocephalus being peculiarly a disease of childhood. It is not, however, as I once erroneously believed, most frequent in very early infancy. In five only of sixty-one fatal cases, in which Dr. West had the opportunity of confirming his diagnosis by an examination of the dead body, were the patients under a year old. Fifteen others were under three years of age; thirty between three and six; five between six and nine; two between nine and ten; one between ten and eleven; and one between twelve and thirteen years old.* The disease may indeed occur at any age up to the twelfth or fourteenth year. After that period it is comparatively rare.

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* Dr. West remarks in a note, that the numbers here quoted probably understate somewhat the frequency of hydrocephalus in early infancy, as they were furnished by his experience at the Children's Hospital, where few are admitted under two years of age.

Do we not trace, in this statement, the same protective influence of the period of lactation, which I formerly mentioned as being so conspicuous in the analogous disorder, strumous ophthalmia?

Acute hydrocephalus usually runs its course in from two to three weeks. It may destroy life within four or five days. It may be protracted, and still prove fatal, to the fourth week of the declared disease.

Whatever tends to deepen and aggravate the scrofulous *diathesis*—improper or insufficient nutriment, exposure to cold, inadequate clothing, impure air—may be regarded as a *predisposing* cause of acute hydrocephalus. And whatever tends to call scrofulous *disease* into action, may be reckoned among the possible *exciting* causes of acute hydrocephalus. Any general irritation may bring it on. It sometimes supervenes upon the drying up or repression of eruptions, as tinea capitis, or sores behind the ears. Such eruptions, therefore, occurring in strumous children, we must not attempt to cure suddenly; and free purging should be employed when they begin to disappear. The irritation produced by difficult and painful dentition is a very frequent exciting cause; and this is a source of danger which, in many cases, may be obviated by timely and judicious management. Violent heating exercise has sometimes, apparently, kindled the cerebral inflammation. Among the exciting causes we may place all physical injuries which jar or stun the brain; blows on the head, falls from a height, although the head may not be the part struck; and all mental agencies which shock or strongly disturb the nervous system; severe bodily pain, violent fits of anger, sudden fright. Gölis goes even so far as to say that great terror and distress of mind *in the mother* during the latter months of pregnancy may lead to the occurrence of acute hydrocephalus in the child; and he brings forward this curious fact in support of his opinion:—A large proportion of the children that were born in Vienna soon after the bombardment of that place by the French, in 1809, were seized with convulsions within a month after their birth, and died of inflammation within the cranium; effusion of coagulable lymph between the membranes, and of serum in the ventricles, being discovered on dissection.

LECTURE XXI.

Acute Hydrocephalus continued. Prognosis and Mortality of the Disease. Treatment; Bleeding; Purgatives; Cold; Mercury; Blisters. Prophylaxis. Spurious Hydrocephalus. Chronic Hydrocephalus, or Dropsy of the Brain. Shape of the Head and Face. Anatomical Conditions. Symptoms.

The disease, of which I described the symptoms in the last lecture, acute hydrocephalus, is a very dangerous disease; and when once it is fairly established, most of the patients die: very few of them recover. Our chance of saving life, by appropriate treatment, is always greater in proportion as the complaint, or the tendency to the complaint, is detected *early*; and for that reason the precursory symptoms possess so high an importance.

When our treatment commences while the symptoms are as yet rather those of the precursory state, than of the confirmed disease, it is impossible to say how many of those cases which, under such treatment, terminate favourably, would otherwise have ripened into well-marked hydrocephalus; and we must be content to have it said, without its being possible for us to refute the assertion, that not all of the disorders which we treat as acute hydrocephalus are really instances of that complaint. We must act upon the worst supposition, and not wait until unequivocal symptoms *demonstrate* that the malady is present, while they demonstrate also, at the same time, that it is well nigh hopeless. These are cases which peculiarly demand decision on the part of the physician; and we are bound to act, in some instances, upon very slight indications: as when, for example, we perceive what we think threatenings of acute hydrocephalus in a scrofulous child, or in a child belonging to a family in which others have already been cut off by that disorder.

It has been supposed by some, that the case is hopeless after effusion has taken place, but we cannot be sure of that; nay more, there are no symptoms by which we can ever tell *for certain* that effusion *has* taken place.

I remember to have heard it gravely maintained, in the debating societies which I sometimes attended when a student, that there are no such things as absorbents, and no absorption, in the brain; and therefore that perfect recovery from serous effusion in that organ is impossible. But this notion is refuted by plain and well-known facts. We shall see hereafter, that blood poured forth within the nervous pulp is capable of being removed by absorption. How an opinion so palpably erroneous could ever have found credit, except with that class of men who can or will believe nothing which they cannot see, I am at a loss to guess.

The prognosis, always doubtful or bad, is a little less unfavourable when the disease is violent, and occurs in tolerably healthy subjects, than when it creeps on slowly and insidiously, and in weakly scrofulous patients. In the former case there is more room for the adoption of remedial measures; and the disease is more likely to be amenable to treatment, and less likely to be invincible; less likely to depend upon a permanent cause, such as the existence of scrofulous tubercles in the brain. We may permit ourselves to take hope from the very uncertainty of our means of diagnosis; hope, that the disease may be simple inflammation, independent of scrofula; a slender hope even then.

The probable issue of the disease is often judged of by the state of the pulse. The quick pulse belonging to the early stages of the disease will become slow; but it may become slow in two very different ways; it may diminish in frequency in a gradual and moderate manner, and then we may hope that the alteration proceeds from the progressive declension of the fever: or it may drop suddenly, which would be a reason for our fearing that the second stage of the disease was about to establish itself. We must take care, under the former circumstances, not prematurely to assert that the disorder is on the decline, and the patient safe. On the other hand, if the pulse have been morbidly slow, a gradual and slight increase in its frequency must be considered as a favourable omen; while its rapid and great acceleration would show that the disease was passing into its worst and final stage.

I have already cautioned you against being misled by that deceitful truce, or that apparent improvement, which is apt to take place in the course of the disease. If the signs of amendment continue, or make progress, during two or three entire days, we may venture to admit a little more hope. But the patient can never be considered secure while any approach to what are thought symptoms of effusion remains; while the pupil continues dilated, for example; or even so long as it does not contract briskly under a strong light.

The prognosis is especially bad when acute hydrocephalus supervenes upon other disease; or when it is engrafted (as it sometimes is) upon the chronic form of the disorder. It is very seldom that the acute form subsides into the chronic.

To show you, however, that we are warranted in the hope of sometimes carrying our patient through this most perilous malady, I will mention a few statistical facts that have been recorded in respect of its mortality. Dr. Odier, of Geneva, states that, upon an average, eighteen cases of acute hydrocephalus occur every year in that place; and of these, six get well; *i.e.*, the recoveries are to the deaths as one to two. Dr. Gölis, to whose work I referred in the last lecture, and who had the charge of a large institution for children in Vienna, gives an account of thirty-seven cases, out of which five recovered. He had seen, upon the whole, forty-one instances of recovery from acute hydrocephalus. Dr. Mills, who has also written on the disease, has narrated twenty-eight cases, all of which died but seven; and Mr. Bricheteau lost four out of eleven. Adding these together, and taking the average, we have seventy-six instances of the disease, and nineteen recoveries; exactly one in four. The cases in which recovery took place were mostly those in which remedial measures were adopted *early*; and I must confess my own suspicion that they were, most of them at least, cases of what I have called *simple* encephalitis, occurring in children previously strong and healthy.

If the 'acute hydrocephalus' of the English, and the 'tubercular meningitis' of the French writers, be allowed to be convertible terms, and to signify always the same disease, we must greatly circumscribe the hope which might otherwise be deducible from the preceding statement. Dr. West declares that he has never yet seen an instance of recovery from advanced hydrocephalus; that he has known but one in which the child got well after the disease was well marked, and the second stage had commenced; and that he had observed a favourable issue in a very few cases only, even though they came under treatment immediately upon the appearance of the premonitory symptoms of water on the brain. And he quotes from M. Guersant, of Paris, 'who has probably had a larger experience than any other man now living in the management of children's diseases,' the following discouraging testimony:—

'Tubercular meningitis may sometims terminate by recovery in the first stage, though the nature of such cases is always more or less doubtful. In the second stage I have not seen one child recover out of a hundred: and even those who seemed to have recovered, have either sunk afterwards under a return of the disease in its acute form, or have died of phthisis. As to patients in whom the disease had reached the third stage, I have never seen them improve, even for a moment.'

The *treatment* of acute hydrocephalus is difficult to conduct; and scarcely less difficult to describe and teach. The disease being essentially an inflammation, invites, in its earlier periods at least, the remedies of inflammation. But we must ever bear in mind that our patients are children; and, for the most part, weakly, because scrofulous children. Their time of life, and the presence of the strumous diathesis, both forbid that strenuous appliance of certain remedies, which might be proper and necessary in adults of strong and healthy frame. We take our weapons, however, in either case, from the same armoury. For we cannot fold our arms and look on in helpless despair. Our object is to rescue our little patient if we can; and if not able to save, we yet may be able to ease his suffering. In whatever way we attempt this, we must be very careful neither to lessen his slender chance of recovery by measures that may harm him, nor to add, in vain, to his bodily discomforts.

The only event of the inflammatory process compatible with the safety of the patient is resolution. To this end, therefore, must our efforts be earnestly directed. If the child be feverish, the pulse sharp, the head hot, the cheeks flushed, the pain severe, and if, moreover, the case be seen early, there need be no doubt about the propriety of taking away blood. It is a matter of obvious importance to ascertain how far we may safely and beneficially carry this measure, in the diseases of infants. Dr. John Clarke, a physician of large experience (the elder brother of the late Sir Charles Clarke), found that very young children would very well bear the loss of blood, even to fainting, once or twice; but that their vital powers were apt to sink if the bleeding, to that extent, were oftener repeated. The best way of taking blood, in these cases, is by leeches. Dr. West wisely advises that the leeches should be applied to the crown of the head, rather than to the temples, where they dangle about the eyes and terrify the child; or than behind the ears, where they are liable to be rubbed off as he rolls his head from side to side. Recollect that, upon very young children, leeches produce an effect tantamount to that of venesection. Their bites bleed more freely than in grown persons, on account of the greater activity of the capillary circulation in children. No general rule can be prescribed in respect to the number of leeches to be used; three will take as much blood in one case as half a dozen in another; but assuming that one leech will, on an average, cause the discharge of one ounce of blood, we may apply three of them to a strong infant of six months, when the symptoms are violent. Of course the further efflux of blood must be stopped if syncope occur. In older children the quantity of blood requisite to be taken will be somewhat larger; six ounces is a full bleeding, I should say, for a child five or six years old. I mention these quantities as mere approximations, as guides to what you may expect to find practically needful: the true measure and test of salutary blood-letting being in this, as well as in other inflammations, the effect it has at the time. The bleeding, in what manner soever the blood be taken, should be a sufficient one; should produce some decided and manifest impression. By attending to this rule you will break the force of the early disease more surely, and more safely too, than by drawing blood in frequent driblets; a mode of using the remedy calculated to subdue the patient rather than to overcome his malady. Very rarely will any repetition of blood-letting, in any way, be advisable or safe. I must once more admonish you that, as you have to deal with scrofulous children, any *superfluous* removal of blood, the abstraction of more than is required for controlling the inflammation within the head, will be likely to prove injurious to the general system; and even dangerously to depress the vital power. After the occurrence of convulsions, or the full formation of the comatose state, a further prosecution of the bleeding has sometimes been rapidly followed by death.

Next in rank and importance to bleeding, if not even before it, come *purgatives.* They are to be exhibited with the threefold view of correcting depraved secretions, of clearing the alimentary canal of its irritating contents, and above all, of deriving, as the phrase is, from the head: producing a discharge of the watery parts of the blood, and taking off the stress upon the cerebral arteries. The best forms of purgative medicine to to be used for these purposes with children, consist of calomel and jalap, or calomel and scammony; and if these do not act freely, senna and salts may be given in aid of them. I have already made you acquainted with Dr. Abercrombie's high estimate of the efficacy of purgatives in inflammation of the brain, whether in the child or in the adult. Dr. Whytt, again, states that he never saw even temporary relief of the symptoms produced by any other means than those which increased the evacuations. Purgatives are to be administered, therefore, at an early period. But sometimes the stomach is so irritable that it rejects them. A previous leeching will sometimes correct this. It is no small part of the benefit derived from the abstraction of blood, that it prepares the way for the more effectual operation of aperients. A large clyster will often be of service, both in settling the stomach, and in procuring stools, when there is much vomiting, and a continual return of medicine given by the mouth. Dr. Cheyne mentions a form of medicine by which he sometimes succeeded in quieting the irritable stomach, and procuring evacuations: namely, a drachm or two of magnesia, saturated with lemon juice, to be given every two or three hours. Dr. West recommends two grains of nitre, with ten of Epsom salts, dissolved in some aromatic water, or in veal broth. You may sometimes get calomel and scammony, however, to remain on the stomach, when almost every other medicine is rejected. The purgative plan should be steadily persisted in for several days.

To show you how torpid and obstinate the bowels are apt to be in this disease, and how difficult it sometimes is to procure evacuations from them, I may mention the following circumstances which I heard Dr. Alison relate as having occurred in the practice of his uncle, the late Dr. James Gregory of Edinburgh. He had one patient who took 140 grains of calomel in the course of five days: yet his bowels were not relieved, till he had also taken two doses of jalap, the first of 30 and the second of 35 grains. In another case, a child of twenty-eight months took in nine days 350 grains of calomel (nearly 40 grains a day); and in six of these days, 136 grains of jalap (more than 20 grains a day): the effects were a gentle purging from the jalap, none from the previous calomel, and but slight salivation. The child recovered after having been in nearly a comatose state. Of course large doses of this kind are never to be given unless and until the inefficacy of smaller ones has been ascertained.

Cold applied to the head:—I have before given you examples of its power. It is especially useful in the early periods of the disease, when there is much heat, and when evacuations have been obtained. I am doubtful about the propriety of keeping *ice* in contact with the surface of the head in very young children. It will in most cases be sufficient to lay a linen rag wet with cold water (or spirit and water, to promote evaporation) upon the child's head, taking care to renew it frequently, not merely as often as it becomes *dry*, but as often as it becomes *hot*. Dr. Darwall states that he has known cases, which seemed utterly hopeless, retrieved by letting water fall in a succession of small drops upon the scalp, and continuing it until the head no longer recovered its high temperature upon intermitting the dropping. I scarcely need say that under all circumstances it is expedient to keep the head somewhat elevated. The influence of this mode of applying cold to the head is increased, and perhaps rendered safer, by immersing the feet and legs of the patient at the same time in warm water.

Different opinions have been held aforetime in respect of the value of mercury in this disease. No one now-a-days, I apprehend, would think of vexing these young patients by giving them mercury with the purpose of producing ptyalism. Indeed, experience has shown that it is a very difficult matter to salivate a child; and this is, perhaps, fortunate. Dr. John Clarke, who employed calomel largely in a variety of diseases, never saw more than three instances in which salivation was produced in children under three years of age.

I have said already that small doses of calomel, as part of the purgative process, are useful sometimes in allaying the morbid irritability of the stomach.

Of the iodide of potassium, which is often prescribed for this complaint, Dr. West speaks with some, but faint, praise. He thinks that he has seen good from its employment; and he mentions one instance of recovery under its use, by Sir William Jenner, from what seemed to be advanced tubercular hydrocephalus. Two grains of the iodide, combined, when the child is feeble and the case equivocal, with half a grain of the sulphate of quinine, given every four hours, is a suitable quantity for a child three years old. He 'recommends this practice as yielding results, on the whole, more encouraging than any other with which he is acquainted.'

Knowing, as we now know, how largely the poison of syphilis may invade and spoil various internal organs of the body, the brain among the rest; knowing, also, how many wretched children come into the world deeply marked and damaged by this fearful inheritance, it seems to me not improbable that some cases of acute hydrocephalus may have their root in this transmitted taint. If so, these would be the cases in which the iodide would be most likely to prove beneficial. But I have no experience on which to ground this conjecture.

Of blisters I may repeat the substance of what I stated when we were considering encephalitis. I should abstain from them at the commencement of the disease. Even when applied at a distance from the head, they are apt to prove a source of hurtful irritation in these young and susceptible subjects. But in the second stage of the malady, I believe blisters may sometimes be of service. They may be applied to the nape of the neck, or, which is better, to the head itself.

These are the main remedies to which we can look, with any hope, in the treatment of acute hydrocephalus: bleeding, purgatives, cold, in the outset; blisters, of more equivocal efficacy than the former, in the more advanced stages of the disease. When there is much irritability towards the decline of the disorder, or in its latest period, opiates may cautiously be tried; they sometimes have appeared to be extremely beneficial: two or three grains of Dover's powder furnish a very eligible form of opiate in such cases.

I do not feel called upon to say anything, in addition to what I stated in a former lecture, about other remedies that have been proposed in acute hydrocephalus; digitalis, colchicum, squills, antimony. These may be useful, when they act as diuretics: but they have no specific virtue. I have told you the remedies which I believe to be the best; and which may save the patient, when judiciously used, if the case be within the compass of our cure; and you will do well to learn how to manage these plain and useful means. I am confident you will find *that* more to your purpose than trying now this and now the other drug, because it is new, or because some persons tell you they have been wonderfully successful with it.

Let me say a word in reference to the *prevention* of this disease: concerning which your advice will be sure to be asked again and again. In families in which acute hydrocephalus has occurred, or which show decided marks of the scrofulous diathesis, the earliest attention should be paid to any deviation from the healthy condition of any of the functions. The milk of a healthy wet-nurse should be substituted for that of the infant's mother; and Dr. West recommends that weaning should be postponed till after four molar teeth have been cut, as well as all the incisors. Weaned children in such families should be kept upon a nourishing but light and unstimulating diet; consisting of well-dressed vegetables, farinaceous substances, and a moderate proportion of animal food. Particular care should be taken to keep the bowels regular; not that weakening purges should be given, but the bowels should be fairly relieved at least once every day. Any disturbance of the digestive organs should be immediately corrected; by antacids, laxatives, change of diet, and sometimes by mercurials. For such correction I have found a powder, composed of a quarter of a grain of calomel, two grains of dry carbonate of soda, and three grains of prepared chalk, extremely useful. These children should also, if possible, be brought up in the country, and freely exposed to mild and dry air; and in winter great care should be taken to have them sufficiently clothed. Exposure to the contagion of small-pox, measles, scarlet fever, or hooping-cough, should be vigilantly guarded against. During the hazardous period of dentition, the state of the teeth and gums must be sedulously watched. There is reason to believe that an issue in the neck or arm has been very serviceable in warding off and preventing attacks of the disease. Dr. Cheyne mentions some striking instances of the good effect of establishing an artificial irritation at some distance from the brain, when there has been a disposition to disease in that organ.

There is another caution, too, which you will often find reason for suggesting: and that is, not to press or encourage the development of the mental faculties in children who are quick and intelligent beyond their years. Parents are apt to be proud of the early acquirements of their little ones: they are not aware that such precocity of the mind implies danger to the health of the body; and they provide them with instructors, and to a certain extent abridge their hours of exercise and amusement, that they may do justice to their cleverness. But it is our duty to admonish such parents of the risk they are thus running: to advise them to think only, for the present, of corroborating the corporal strength of the child; and to avoid much cultivation of his intellect until this dangerous period of his existence is got over.

There is still one point remaining, and one of the utmost importance, in relation to the acute hydrocephalus of children. I told you in the last lecture, that in general the diagnosis was not very difficult. But there is a form of disorder very apt to be mistaken and treated for acute hydrocephalus, by those who are not forewarned; and one which may be rendered fatal, if the *remedies* of acute hydrocephalus be directed against it. Encephalitis, whether it occur in the child or in the adult, has its spurious double. As, in morals, every virtue has its corresponding vice, which apes its actions and assumes its garb, so it is also with many opposite bodily disorders: and it is of great moment that we should be capable of discerning the essential difference of character that lurks behind external similarity of feature. It is a curious, but unquestionable fact, that *anæmia* of the brain, a diminution of its natural supply of red blood, and exhaustion of the nervous power, will produce symptoms very much resembling those which result from the diametrically opposite condition. To excess of pressure on the one hand, and to defect of pressure or support on the other, there are many phenomena in common. If you pay no regard to the state of the general circulation, as indicated by the temperature and by the pulse, you will find the actual symptoms of syncope, and of apoplectic fulness, to be identically the same. When a human being bleeds to death,—as many do from wounds, from uterine hæmorrhage, and so on,—what do we see? Why the patients may have nervous delirium, become convulsed, and then insensible, with a wide and fixed pupil. The outward visible signs of concussion and of compression of the brain are very much alike. The vulgar always confound them, and are clamorous that a vein should be opened: a measure which might be proper and useful in the one case, but would be murderous in the other. It is the same with the functions of other parts: we have palpitation of the heart when that organ is insufficiently supplied with blood; palpitation when it is over-loaded: dyspnœa, or hurried breathing, when the lungs are congested; hurried breathing, when blood does not arrive in them plentifully enough. You must see that the importance of distinguishing between the causes of these analogous phenomena is immense. Several authors in modern times have noticed the condition of the brain to which I now wish you to attend, and which may be called *spurious hydrocephalus*. Dr. Marshall Hall, Dr. Abercrombie, and the late Dr. Gooch,—each of these three physicians appears to have discriminated, for himself, the spurious from the genuine disease; but their several accounts of it were made public in the order of time in which I have here mentioned their names. Dr. Gooch's essay is entitled—'Of some Symptoms in Children erroneously attributed to Congestion of the Brain.' His description of the disorder in question is very graphic. It is chiefly indicated, he says, by heaviness of the head, and drowsiness. The age of the little patients whom he had seen so affected was from a few months to two or three years; they were generally small of their age, and of delicate health, or had been exposed to debilitating causes. The physician finds the child lying on its nurse's lap, unable or unwilling to raise its head; half asleep; one moment opening its eyes, and the next closing them again, with a remarkable expression of languor. The tongue is slightly white, the skin is not hot; at times the nurse remarks that it is colder than natural; in some instances there is now and then a slight and transient blush. In all the cases that Dr. Gooch saw, the bowels had been already disturbed by purgatives; the symptoms had invariably been attributed to congestion of the brain; and the remedies employed had been leeches and cold lotions to the head, and purgatives—especially calomel. Under this treatment the patients had gradually got worse, the languor had increased, the pulse become quicker and weaker, and at the end of a certain number of days the children had died. In two instances he had known coma to come on during the last few hours; stertorous breathing, and dilated and motionless pupils.

Dr. Hall describes a very similar set of symptoms: the face pale, the cheeks cool or cold, the eyelids half closed, the eyes unattracted by any object put before them, the pupils unmoved on the approach of light, the breathing irregular and suspirious, the voice husky. These symptoms are sometimes preceded by irritability, and a feeble attempt at reaction; in which case the diagnosis requires extreme care and circumspection. He attributes the disorder, which he calls the 'hydrocephal*oid* disease,' principally to exhaustion. In early infancy the exhaustion owes its origin chiefly to diarrhœa, or catharsis; in the later periods of infancy, to the loss of blood, with or without a relaxed condition of the bowels. The diarrhœa is often produced by improper food, and frequently succeeds weaning; or it results from the ill-timed administration of purgative medicine. The exhaustion from loss of blood generally follows the application of leeches, for some previous complaint—or for this very complaint itself, when incipient and misunderstood.

I will take one of Dr. Gooch's cases in illustration, and give it you in his own words. 'I was going out of town (he says) one afternoon, when a gentleman drove up to my door in a coach, and entreated me to go and see his child, which he said had something the matter with its head, and that the medical attendant of the family was in the house, and was just going to apply leeches. I went with him immediately, and when I entered the nursery I found a child ten months old, lying in its nurse's lap, exactly in the state which I have already described;

the same unwillingness to hold its head up, the same drowsiness, languor, absence of heat and all symptoms of fever. The child was not small of its age, and had not been weak; but it had been *weaned* about two months, since which it had never thriven. The leeches had not been put on. I took the medical gentleman into another room, related the foregoing case (*i.e.*, a case in which a child had been leeched out of its life), and several similar to it, which had been treated in the same way, and had *died* in the same way. Then I related to him a similar case which I had seen in the neighbouring square, which had been treated with ammonia and decoction of bark, and good diet, and which had recovered; not slowly, so as to make it doubtful whether the treatment was the cause of the recovery, but so speedily that at a third visit I took my leave. He consented to postpone the leeches, and to pursue the plan which I recommended. We directed the gruel diet to be left off, and no other to be given than ass's milk, of which the child was to take at least a pint and a half, and at most a quart, in the twenty-four hours. Its medicine was ten minims of the aromatic spirit of ammonia in a small draught every four hours. When we met the next day the appearance of the child proved that our measures had been right; the nurse was walking about the nursery with it upright in her arms. It looked happy and laughing. The same plan was continued another day; the next day it was so well that I took my leave, merely directing the ammonia to be given at longer intervals, and thus gradually withdrawn; the ass's milk to be continued, which kept the bowels sufficiently open without aperient medicine.' This case contains both a picture of the morbid state, and a summary account of the treatment it requires. Instead of the sal volatile, you may occasionally substitute with advantage from five to ten drops of brandy mixed with arrowroot. You are to restrain diarrhœa, if it exist; give the child plain nourishing diet—there is none so good for it as that furnished from a healthy mother's breast; caution the nurse or mother against raising it into the upright position; keep its extremities warm with flannel; and, if the season permit, let a current of mild fresh air blow freely over it.

Bear in mind, then, the distinctive characters of this spurious hydrocephalus—the pale, cool cheek; the half-shut, regardless eye; the insensible pupil; the interrupted, sighing respiration; and when the mere symptoms are more ambiguous, your judgment concerning the true nature of the case will be much aided by tracing the manner in which they came on, and the causes to which they seem to be attributable. In very young children —in respect of whom the question is most likely to arise—you may often determine between congestion and exhaustion, between fulness and emptiness, between too much and too little pressure, by a very simple and easy test, which is not adverted to, so far as I remember, by any of the three writers whom I have mentioned. I mean by taking notice of the state of the unclosed fontanelle. If the symptoms proceed from plethora, or inflammation, or an approach to inflammation, you will find the surface of the fontanelle convex and prominent, and you may safely employ, and expect benefit from, depletion. If, on the other hand, the symptoms originate in emptiness and want of support, the surface of the fontanelle will be concave and depressed; and in that case leeches, or other evacuants, will do harm, and you must prescribe better diet, ammonia, and so forth.

All that has hitherto been said has reference to *acute* hydrocephalus, which is an *inflammation*. I have next to speak of *chronic* hydrocephalus, which is a *dropsy*. From some cause, not well understood, a watery fluid collects within the skull, most commonly in the ventricles of the brain; and this occurring at the earlier periods of life, before the whole of the brain-case has become solid, the containing parts yield to the increasing pressure, and the size of the head is augmented in various degrees; at the same time the cerebral functions are more or less deranged. This dropsy of the cranial cavity often commences before the period of intra-uterine life is completed, and the head of the fœtus becomes so large that it cannot pass with safety into the world. Accordingly, many of these infants perish at the moment when their separate existence commences —*nascentes moriuntur.* The pressure of the maternal pelvis is fatal to them; or the diseased head bursts; or it is crushed by the accoucheur, to preserve the life of the mother. The skull is emptied of its contents, and the shell, if I may so call it, collapsing, passes through the natural outlets.

In many cases, however, the dropsical skull is expelled entire and unhurt, and the infant lives for a shorter or a longer period. Sometimes the fluid does not begin to accumulate till after birth: in a few days, however, or after some weeks, or some months even, the head is perceived to enlarge with a rapidity quite disproportioned to the growth of the other parts of the body; and enlarging, it becomes misshapen also. The intervention of the membranous partitions called fontanelles and open sutures, between the ununited bones, allows the centrifugal pressure of the gradually accumulating water to modify the shape of the head. These membranous interspaces are unnaturally wide, and more numerous than in healthy children. Nevertheless the process of ossification goes on, but the bones are extremely thin. We see little islands of bone in lakes (as it were) of membrane. By degrees, if the child survive, the proportion of membrane to bone becomes less and less, and at length the whole brain-case is hard, and firmly closed up, its surface exhibiting an unusual number of joinings; there are many *ossa triquetra*.

In the meantime the direction and relations of the loose and yielding bones are altered. The os frontis is tilted forwards, so that the forehead, instead of receding a little, rises perpendicularly, or even juts out at its upper part, and overhangs the brow. The orbitar plates of this bone are apt to be forced downwards, made to slant backwards, and flattened; sometimes they are rendered even convex towards the orbits. The parietal bones bulge above towards the sides; the occiput is pushed back; and the head becomes long, broad, and deep, but flattened on the top. This, at least, is the most ordinary result. In some instances, however, the skull rises up in a conical form, like a sugar-loaf. Not unfrequently the whole head is irregularly deformed, the two sides being unsymmetrical. Some of these rarer varieties of form are fixed and connate; others are owing, probably, to the kind of external pressure to which the head has been subjected.

I may here mention some points of distinction furnished by the shape of the enlarged head, between chronic hydrocephalus and hypertrophy of the brain. The enlargement in hypertrophy is first noticeable, and the bulging continues throughout the most pronounced, at the occiput. The forehead may ultimately come to project, but the eye remains deep sunk in its socket, no change having been produced in the direction of the orbitar plates, giving the eye undue prominence and a downward direction, as in hydrocephalus. Again, while in hydrocephalus the anterior fontanelle is tense and convex, there is no such protrusion in cases of hypertrophy, but on the contrary, an actual depression in that situation, and according to Dr. West's observation, at all the sutures.

While the *skull* may be rapidly enlarging, the bones of the *face* grow no faster than usual, perhaps not even so fast; and the disproportion that results gives an odd and peculiar physiognomy to the unhappy beings who are the subjects of this calamity. They have not the usual round or oval face of childhood. The forehead is broad, and the outline of the features tapers towards the chin. The visage is triangular. This great disproportion of size between the head and the face is diagnostic of the disease, and would serve to distinguish the skull of a hydrocephalic child from that of a giant. Heartless parents sometimes make a wretched profit of the deformity. A penny show of this kind existed very recently in the immediate neighbourhood of this College.

When, after death, we explore the physical causes of these singular deviations from the natural figure and bulk of the cranium, we find that they proceed from the pressure of accumulated water: the complaint is manifestly a dropsy. But the situation of the water, and the condition of the brain itself, are subject to some curious varieties.

In a certain number of cases the brain is incompletely formed; deficient in some of its parts, or even altogether wanting. That portion of the cranial cavity which should contain the nervous pulp is filled up by a thin pellucid fluid. From some unknown cause, operating during the period of intra-uterine life, the progressive formation of the brain has been arrested. Marks of imperfect development are often visible in other parts of the same infants; they have a hare-lip, a bifid spine, or a split palate. It is in cases of this kind generally that the skull, unnaturally small perhaps, is pinched up into a conical peak, and has considerable thickness. They are obviously hopeless cases. To the physiologist they are subjects of much interest; for the practical physician they have none.

But in the majority of instances, when the infants survive their birth, the liquid is contained in the central cavities or ventricles of the brain, which are expanded into one. The convolutions are unfolded, and the cerebral matter is spread out into a hollow sphere; the irregularities of the surface have disappeared; the whole of the brain is smoothly extended in a thin layer, immediately beneath the bones and the membranes that connect them, and surrounds the enclosed liquid like a bag. Less frequently a different state of matters is seen. The liquid, instead of being included within the cerebral substance, lies in the cavity of the arachnoid, close to the dura mater; while the brain, perfect in all its essential parts, is at the bottom of the cavity. The difference, however, is more apparent than real: the two conditions are substantially the same, only that, in the one case, the solid parts that lie around the ventricles gradually expand as the fluid slowly collects, much as an air-balloon dilates in proportion as gas is introduced within it; while in the other case the seams or commissures (as they are technically called), that unite the hemispheres of the brain, give way, or are deficient, so that the ventricles, and the general sac of the arachnoid, form together one huge cavity; the hemispheres are turned aside, or folded back; the surfaces that naturally have a *central* aspect look *upwards*, and seem to constitute the summit of the cerebrum. This was the state of the parts within the immense skull from which the largest of the casts before you was taken. It belonged to a man named Cardinal, who died in Guy's Hospital, in 1825, and of whom Dr. Bright has given a very interesting account.

Now some of the consequences of this distension of the brain and skull with watery fluid are simply mechanical. The child is top-heavy. His large unwieldy head is too much for the muscles of his neck to sustain without fatigue; or even, when they are unassisted, to sustain at all. He walks gently and carefully, like a person balancing a heavy load upon his head; or he holds and partly carries his head with his hands, as a milkmaid steadies and supports her pail; or he reclines the weight of his burden upon the chair, or table, as he sits.

But far more important effects of the disease are those which relate to the three great functions of the brain. The child is soon found to be blind; or, what however is less common, deaf; or palsied in one or more of its limbs; or idiotic; or all these. In other words, the special senses, the power of voluntary motion, and the mental faculties, are apt to be defective or perverted. Instances, however, do occur, in which these functions are, for some time, but little deranged. The greater number of those who are afflicted with dropsy of the brain either recover, or die during their infancy. Still, a few survive, bearing their complaint to the adult period, and even to old age; and in some of these individuals, who, with excessively large heads, have yet numbered many years of existence, the intellect and the senses, if not entire and perfect, have been sufficiently effective to answer the common wants and purposes of social life: the moral emotions strong, the feelings lively and correct, the memory tolerably retentive, the reasoning powers respectable. Dr. David Monro relates the case of a hydrocephalic girl, six years old, whose head measured two feet four inches in circumference. She is described by him as being 'as lively and sensible as most of her age,' and as 'having a strong memory.' Dr. Bright's patient, Cardinal, was nearly thirty years of age when he died. He was born in 1795. At the time of his birth, his head was only a little larger than natural; but it had a pulpy feel, as if it were almost destitute of bony matter. A fortnight afterwards it began to increase rapidly, and when he was five years old, it was but little less, according to his mother's account, than when he died. He could not walk alone till he was nearly six, and then only on level ground. If he attempted to run, or to stoop, he fell down. He was sent to school when he was about six, and soon learned to read well and to write tolerably; but writing he soon gave up, because, as he was near-sighted, it obliged him to stoop, which he could not conveniently do. When a candle was held behind his head, or when his head happened to be between a spectator and the sun, the cranium appeared semi-transparent; and this was more or less the case till he was fourteen years old. About the age of twenty-three, epileptic fits began to occur; and after that his health, which previously had been very good, failed somewhat. The ossification of the skull was not complete till two years before his death, the anterior fontanelle being the last part that closed. It has been mentioned that he was near-sighted; but he was very quick of hearing, his taste was perfect, and his digestion good. Dr. Bright states that his mental faculties were very fair, and his memory tolerable; but it was not retentive of dates. It was said that he was never known to dream. There was something childish and irritable in his manner, and he was easily provoked. He died, at last, of fever and diarrhœa. There were seven or eight pints of fluid within the cranium, in contact with the dura mater. On the base, or floor, of the skull lay the brain, with its hemispheres opened outwards, like the leaves of a book.

How comes it that the cerebral functions are thus sometimes fulfilled, or go on so well, when the machinery through which the mental powers are manifested—the instrument whereon or whereby the thinking principle mysteriously operates—is so palpably and greatly deranged? How comes it that life, and especially the life of the mind, subsists at all? These questions open very interesting considerations. It would appear, from such cases as I have been referring to, that the curious arrangement and collocation of the several parts of the brain are rather matters of convenient package than of necessary relation. The pulp which furnishes the medium of sense, and thought, and volition, is there, but it is disposed in an unusual shape. In neither of the two varieties of the malady that have been described as being compatible with prolonged existence, is there any necessary diminution of the cerebral mass. The brain itself, which forms a bag in the one case, and is split in halves in the other, has been found to weigh quite as much as a healthy brain at the same period of life. There has been no loss, therefore, of substance; the pressure has been gradual, and it has not been made to act injuriously by counter-pressure; no effectual resistance has been afforded by the rigidity of the brain-case: and thus the unopposed distending force neither causes absorption of the cerebral pulp on the one hand, nor, on the other, induces coma, or convulsions, or idiotcy, by its compression.

Most commonly, however, the mental and voluntary functions are maimed or perverted; and these serious calamities make parents look at a large head in a young child with anxious solicitude. But you are aware, after what I stated on this subject in the last lecture, that the head *may* be extravagantly large without dropsy of the brain, and without disease.

We have just seen, that while the brain itself is gradually unfolded, or its hemispheres are parted and turned aside, by the liquid accumulating within the cranium, the functions of the organ may suffer but little, so long as the yielding brain-case permits the expansion or separation of the nervous substance, without inordinate pressure. But as soon as undue pressure begins to be exercised, then morbid symptoms arise, or the defects that have previously shown themselves are aggravated. Hence that period of life becomes a perilous period, at which the skull, by the closure of its fontanelles and sutures, loses its capability of further expansion. In some rare cases the closed sutures re-open under the augmenting pressure, and a respite is thus obtained. Dr. Baillie has recorded an instance in which this happened in a boy seven years old. A similar case is mentioned in Dr. Yeats' work on hydrocephalus. The patient was a boy nine years of age. The sutures of his skull separated again after having been united; and it was remarked that the teeth in the jagged edges, whereby the bones interlock with each other, were much fewer than is usual. If this be always so when the sutures give way, it will serve to facilitate our understanding how such a separation can take place. The skull may, however, go on expanding, although the sutures are permanently closed; there still being left intervals between the several points of ossification, which intervals are covered by membrane only. The beautiful preparation on the table, showing this remarkable state of the cranium, I have borrowed for your inspection from Dr. Sweatman's museum.

Indeed, although I have spoken of this complaint as being especially a disease of childhood, it does occasionally commence long after the skull has become a complete case of bone. Enlargement of the head, in these cases, is impossible; but this circumstance, and the symptoms it is apt mechanically to produce, form the only differences between the disorder as it affects the child and the adult. In both cases disturbance of the cerebral functions arises, and at length convulsions or coma close the scene. In both, a dropsical state of the ventricles of the brain constitutes, often, the only morbid change presented after death. A young and distinguished lawyer of my acquaintance had one or two attacks of rather sudden loss of consciousness, while engaged in the Court of Chancery; by degrees he became dull, stupid, forgetful, and, at length, insensible. In this condition he died. A large quantity of serous liquid was found distending the ventricles of his brain. No other alteration could be detected.

I had known, by sight only, for many years, first at Cambridge, and afterwards about London, a tall gentleman who had in a remarkable degree that erect, cautious, and self-balancing gait which I just now mentioned. At length I was summoned to see him in consultation with the late Sir Benjamin Brodie. He was dying, with some obscure head symptoms. Upon examination of his head, the skull was found to be of extraordinary thickness, with very wide diplöe. The lateral ventricles of the brain contained a very large quantity of clear fluid, and formed a great vaulted cavity when the fluid was poured out. These conditions were obviously of old standing.

Dr. Baillie describes a case of chronic hydrocephalus that occurred in a man fifty years old. Six ounces of fluid were contained in the lateral ventricles. He had been paralytic on the right side of the body; and for eleven months before his death had lost the use of his own language, with the exception of four or five words; which he employed, with different intonations, to express his various wants.

The celebrated Dean of St. Patrick's afforded another instance of the same disease, attended with a similar interruption of the power of discoursing. The case, as related in Sir Walter Scott's 'Life of Dean Swift,' is curious, and contains an early suggestion of a piece of practice which in our own time has met with more favour. 'A few days afterwards he sunk into a state of total insensibility, slept much, and could not without great difficulty be prevailed on to walk across the room. This was the effect of another bodily disease, his brain being loaded with water. Mr. Stevens, an ingenious clergyman of his chapter, pronounced this to be the case during his illness, and upon opening his head it appeared that he was not mistaken; but though he often entreated the Dean's friends and physicians that his skull might be trepanned, and the water discharged, no regard was paid to his opinion or advice.'

He remained from October, 1742, to October, 1745, in a state of silence, with few and slight exceptions; and died in the 78th year of his age.

Gölis also mentions three instances in which this disease began in advanced life; two of the patients were above seventy years old; the third, who was a physician at Vienna, likewise died in the decline of life, having suffered under the disorder for ten years.

Now, what can we do in these wretched cases? Seldom much good, I am afraid. Yet something we must try, for parents will flatter themselves with hopes of a cure: and, to say the truth, there have been, under judicious management, a sufficient number of recoveries to forbid our despairing in any case, and to make it incumbent upon us to employ carefully all those measures which have occasionally brought the disease to a favourable termination. Gölis even affirms, that of the cases which began after birth, and which he saw and treated early, he was fortunate enough to save the majority.

LECTURE XXII.

Treatment of Chronic Hydrocephalus; Internal Remedies; Mechanical Expedients; Bandages, Tapping. Symptoms of Spinal Disease. Inflammatory conditions of the Spinal Marrow.

THE cure of chronic hydrocephalus may be attempted by internal remedies, or by external mechanical expedients, or by both.

The internal remedies by which most good appears to have been effected, and from which, therefore, most is to be hoped, are diuretics, purgatives, and mercury, which is believed by many to have a special and powerful influence in promoting absorption. Conjointly with these, the abstraction of small quantities of blood from the head from time to time, by means of leeches, has been found beneficial.

Gölis advises that calomel should be given in half-grain doses, twice a day; or, if that quantity should purge too much, in doses containing only one-fourth of a grain. At the same time he would rub a scruple or two of mercurial ointment mixed with ointment of juniper berries, upon the scalp, every night. He recommends that the head should be kept constantly covered also by a woollen cap. Infants require, he says, no other nutriment than good breast milk; while older patients should take a moderate quantity of meat. In mild weather they should be as much as possible in the open air. Under this plan of treatment he affirms that he has known the circumference of the head decrease by half an inch or an inch, in a period of six weeks or three months; and that perseverance in this method has frequently, in his experience, been followed by perfect recovery, both of the mental and of the bodily powers. If no improvement should be perceptible in two months, he advises that diuretics should be given, *with* the former remedies, the acetate of potash, or squills, or both: that an issue should be made in the neck, or in each arm, and be kept discharging for several months. And he thinks that when convalescence has once begun, it may often be much accelerated by minute doses of quina; the fourth of a grain, for example, thrice daily.

In a disease so unpromising as chronic hydrocephalus, we are warranted in trying any plan that has been found, or supposed, to be useful. An apothecary of considerable experience —now dead—once took the pains to write out and send me the particulars of two cases in which he had seen a peculiar mode of administering mercury successful. I will give you them in nearly his own words.

In the year 1817, he had under his care a lad, named Scott, labouring under chronic hydrocephalus. He had been ill two or three years, was nearly blind, had very little use of his lower extremities, and could not walk across the room without support. He suffered violent pains in his head, and was unable to bear the least pressure on his scalp. His bowels were constipated, and his pulse 'oppressed.' Cupping and blistering, the blue pill, drastic purgatives, and ordinary diuretics, tried in combination and succession, gave him temporary relief; but no permanent benefit was obtained. Dr. Gower then suggested a plan which he had himself found successful in such cases, and which had first been used by Dr. Carmichael Smith, who had recorded ten cases of recovery under its adoption. Dr. Gower's plan was to rub down ten grains of crude mercury with about a scruple of manna, and five grains of *fresh* squills: this was to be one dose: and it was to be repeated every eight hours.

My informant rubbed the quicksilver down with conserve of roses, and then added the fresh squills, making the whole into the consistence proper for pills with liquorice powder. The patient took this dose three times a day, for nearly three weeks, without any ptyalism being produced. Its effects were great prostration of strength, and loss of flesh, with gradual relief of all the boy's sufferings. It operated profusely by the kidneys. The medicine was continued twice a day, and at length once, for another fortnight; when all the symptoms of the disease had disappeared. The boy was greatly emaciated. He was then ordered an ounce and half of Griffith's mixture thrice daily; and soon regained his health and strength, and got quite well. He remained well eight years afterwards.

The success obtained in this case led to the pursuance of a similar course in that of the son of a well-known fishmonger in Old Bond Street. He was about twelve years old, and afflicted in nearly the same manner as Scott, except that the pain in his head was more acute, and caused violent screaming: *relief* had been repeatedly given, for a time, by cupping. The physician in attendance was unwilling to try the plan, when it was proposed to him, but said that he would give what was equivalent—small doses of blue pill, with squills in powder. The result was salivation in a few days, without any amendment. In about three weeks, the local effects of the mercury having subsided, and the patient then suffering extreme pain in the head, loss of sight, and want of power over the lower extremities, my informant was desired to adopt any measures he thought fitting. The medicine was given as in the former case, and with the same happy consequence. It acted, as before, without producing ptyalism, but with a great reduction of strength and flesh. Health was restored by steel, after the symptoms of hydrocephalus had disappeared. This cure also was permanent.

I think you will give me credit for not being over fond of recommending what may be called *crotchets*, instead of well-tried and approved means of cure; but I say that in such a complaint as chronic hydrocephalus, we have generally the opportunity of testing the virtues of many reputed remedies, one after another; and we are not to despise or neglect any measures that have been found beneficial, merely because they are out of the way, or because we cannot see in what manner they can excel the more common formulæ.

You will observe that these were cases in which the disease came on some time after the sutures of the skull had closed.

The mechanical remedies of chronic hydrocephalus are two: and they have a totally opposite mode of action. By the one, the brain is compressed; by the other, it is lightened of its pressure: yet both of them have proved successful. What does this show? what, but a confirmation of the doctrine that there are different states of the encephalon, very dissimilar in their essential characters, yet having some symptoms in common; and those the most likely of all to catch our attention? Such common symptoms resemble an algebraical symbol, which derives its value from the plus or minus sign prefixed to it. Surely it is of vital importance to study, and if we can to settle, the differences whereby these inverse conditions, requiring contrary remedies, may be discriminated.

Bandaging the head is one of these two expedients; *puncturing* it the other. Neither of them is practically applicable after the bones of the skull have united.

Bandages appear to have been suggested by the notion that the increase of the fluid within the head, and probably some of the symptoms too, might depend, more or less, upon the want of firmness and proper resistance in the outer containing parts; in the feeble and half solid skull. A certain amount of support and pressure is requisite for the due exercise of the cerebral functions. Beyond this amount all increase of pressure is hurtful. The middle point of safety it may be hard to hit. It is certain that the easy yielding of the bony walls of the head, by reason of the membranous interspaces that exist in the early periods of life, proves oftentimes the safety of these patients. If the skull did not expand as the water gathered, morbid symptoms would ensue. Great nicety must therefore be requisite in the use of this remedy. While the head is palpably enlarging, compression by means of plasters or bandages would probably be mischievous. When the disease is stationary, and the unconnected bones of the skull are loose and fluctuating, and the child is pale and languid, much benefit may be expected from moderate and well-regulated support. The late Sir Gilbert Blane was the first, I believe, to suggest this mode of treatment; but its safety and efficacy were afterwards demonstrated by Mr. Barnard, who has related several examples of complete success from the employment of bandages. In these cases the children were pale, bloated, and feeble, with flabby muscles; the bones of their heads were moveable and floating, and the functions of the brain more or less impaired. Mr. Barnard applied strips of adhesive plaster, about three-quarters of an inch wide, completely round the head from before backwards; covering the forehead from the eyebrows to the hair of the head, as low down on the sides as the ears would permit, and lapping over each other behind. Then, cross-strips were carried from one side of the head to the other, over the crown; and lastly, one long slip, reaching from the forehead, within half an inch of the root of the nose, over the vertex to the nape of the neck. In his first trial of this plan, but never afterwards, Mr. Barnard laid pieces of linen, wetted with cold water, over the plasters. The only internal medicine given was castor-oil, to regulate the bowels. The effects, in all this gentleman's cases, were these: a gradual diminution of the size of the head; mitigation, and ultimate disappearance, of all head symptoms, such as strabismus, rolling of the eyes, starting of the muscles, and convulsions: and at the same time, increased tone of the muscular system, with an improved appearance of the skin, and of the secretions from the bowels. These are striking results. They show that, in certain conditions of chronic hydrocephalus, a part of the danger arises from a lack of due support and confinement of the brain; and they prove that compression alone may be equal to the cure. To such cases, Dr. Arnott's air-press would seem, from the facility with which its equable compressing force may be regulated, to be especially adapted.

But in children who are not of this pale and feeble habit, and in whom ossification of the skull goes on, the period when the walls cease to yield is the period of danger. The water continuing to accumulate, inordinate pressure begins to take place. Under these circumstances, the application of bandages or plasters must, if nothing else be done, be insufficient or unsafe. The brain-case being no longer capable of expansion, there remains to be attempted a reduction of the quantity of the liquid which it contains.

Now, any considerable diminution of the accumulated fluid, through the agency of mere absorption, is scarcely to be expected; even although we endeavour to aid that process by applying leeches and cold to the head, and by purgatives, or diuretics, or diaphoretics. Some mode, more certain and effectual, of emptying the distended cavity, has therefore been earnestly sought after; and the second mechanical expedient of which I have spoken offers a very sure method of attaining this object. He must have been a bold physician who first proposed to decant the water from the brain, by means of a perforation, made with a trocar, through the membrane of the fontanelle, through the membranes of the brain, and through even the expanded cerebral substance itself. But the success of the project has amply vindicated his happy audacity. It is not a very new suggestion, but it has received particular attention in this country of late years; and though tapping the brain in chronic hydrocephalus has been denounced as useless and cruel by some high continental authorities, by Gölis and Richter especially, it furnishes one of the best of the few chances of safety to the patient. Of course I mean ultimate safety, for the operation itself is attended with the present risk of accelerating the patient's death. Other means, however, failing, we are justified in advising that hazard. We have to consider, that by performing the operation, we incur the danger of abbreviating the existence of a being, whose life, without it, could scarcely be long continued, or capable of enjoyment: but then we afford *some* chance of a perfect cure. A speedy death, or an uncertain life of mental and bodily imbecility, or complete restoration: these are the three events to be looked at. Of the three, the second is, in my judgment, incomparably the worst; and if the case were my own, if I had to decide the painful question in reference to one of my own children, I would accept the alternative of probable speedy death on the one hand; possible complete recovery on the other.

To say the truth, the *immediate* danger is not so very great as you might suppose; provided that the operation be skilfully and cautiously performed, and only a moderate quantity of water drawn off at a time. That even a very rough operation is not necessarily fatal we learn from a singular case related by Mr. Greatwood. A child, fifteen months old, afflicted with chronic hydrocephalus, fell down, and struck the back part of its head against a nail, which penetrated the skull. Above three pints of water gradually flowed out at the orifice thus made, and the child was cured.

In some rare cases the imprisoned liquid has found a natural vent, and dribbled away, through foramina in the bones of the skull communicating with the nostrils. In this manner injurious pressure has been relieved, or for a while staved off.

I will mention a few instances in which tapping the brain has been performed; for I know no better mode of showing you the manner in which the operation should be done, the cautions to be attended to in doing it, and what kind of success it has had.

There is an account of the performance of this operation by Lecat, in the 'Philosophical Transactions' for the year 1751. This date is subsequent to the period when the Rev. Mr. Stevens suggested the propriety of trepanning Dean Swift's cranium. In 1778, Dr. Remmet, of Plymouth, punctured the head of a hydrocephalic child on five several occasions, with a lancet, and took away, in all, no less than eighty ounces of fluid; five pints, as pints were measured in that day. The child died seventeen days after the last tapping. A very interesting case of the same kind is related by Dr. Vose, of Liverpool. His patient was an infant seven months old. Its head was more than twice the ordinary size. Three operations were performed; the first with a couching needle. Upwards of three ounces were on that occasion let out; and it was estimated that about the same quantity dribbled away afterwards. The child thereupon became very weak, but was presently revived by some cordial medicine. About six weeks afterwards, the liquid having again collected, an opening was made with a bistoury, and eight ounces were removed; and nine days after that, twelve ounces more, without any bad consequences. The head diminished in size, the patient got apparently well, and the case was published as a successful one. Unfortunately, however, upon the closure of the sutures by ossification, the complaint returned, and the child died of it.

Mr. Lizars, of Edinburgh, operated upon a little patient of his twenty times in the course of three months; using a small trocar. Dilatation of the pupils, and squinting, which had previously existed, ceased immediately upon the escape of the water. The child recovered. But in this case also, as in Dr. Vose's, the success was temporary only. The head at the period of teething again enlarged, and again the tapping was performed; but the little patient sunk. Another very striking and instructive instance is recorded by Mr. Russell, of Edinburgh. The patient was an infant three months old, with an enormous head; twenty-three inches in circumference, and fifteen inches and a half from one ear to the other. The child was affected with strabismus, and a perpetual rolling of the eyes. The usual routine measures, compression among the rest, had been employed without any success. By four operations, performed at intervals of about ten days, the size of the head was considerably reduced: but, the fluid continuing to collect, calomel was given in small and frequent doses, and the gums became sore, and the child got well. At eight months old the dimensions of the head were less, by four inches in circumference, and by two inches and a half across the vertex, than they had been before the first tapping; and the sutures had entirely closed.

But the late Dr. Conquest, more than any other person, gave authority to these operations. In a paper published in the 'Medical Gazette,' in March, 1838, he tells us that he had then tapped the heads of nineteen children for this complaint, and in ten of the nineteen cases the children survived. Very little is known of the subsequent fate of these ten cases. Of the condition of three only, at a later period, is there any record. Not one of the three was in a very satisfactory state. Dr. Conquest introduced a small trocar through the coronal suture below the anterior fontanelle, and cautiously made pressure upon the head afterwards by means of strips of adhesive plaster; and he closed the wound in the integuments carefully after each time of puncturing. The greatest quantity of liquid withdrawn by him, at any one time, was twenty ounces and a half; and the greatest number of operations on any one child were five, performed at intervals of from two to six weeks. The largest total quantity of water removed was fifty-seven or fifty-eight ounces, by five successive tappings.

This expedient, though doubtless hazardous, must be deemed to possess a certain value. The rules relating to its performance may be briefly summed up. The operation should scarcely be had recourse to until other means have failed. The trocar should be small, and it should be introduced perpendicularly to the surface, at the edge of the anterior fontanelle; so as to be as much as possible out of the way of the longitudinal sinus, and of the great veins that empty themselves therein. The fluid should be allowed to issue very slowly; and a part only of it should be let out at once. The instant that the pulse becomes weak, or the dilated pupil contracts, or the expression of the child's countenance manifestly alters, the canula should be withdrawn, and the aperture in the skull closed. Gentle compression should be carefully made to compensate, in some degree at least, the pressure that has been removed with the fluid. Should the infant become pale and faint, it must be placed in the horizontal posture; and a few drops of sal volatile, or of brandy, mixed with water, may be given. Sometimes slight inflammatory action comes on in the course of a day or two after the tapping. When this happens, we must apply cold lotions, or leeches, and use the other remedies which I mentioned before, as proper to subdue such inflammation.

It has been thought that the operation is more likely to succeed in the rarer case of arachnoidean than in the more common case of ventricular hydrocephalus. But supposing this to be so (which, however, is very questionable) how are we to discriminate between these two conditions?

Partly, we are told, by the character of the accumulated fluid; and this may be ascertained by introducing a grooved needle through the membrane. Serous fluid in the cavity of the arachnoid is sometimes a consequence of a previous extravasation of blood in the same part; and, thus arising, it is apt to be tinged with blood and to contain a sensible proportion of albumen. Whereas in dropsy of the ventricles the liquid is almost as limpid as water, and holds little or no albumen in solution.

This criterion cannot, however, be implicitly relied on. The liquid withdrawn from the cerebral ventricles is sometimes red and albuminous.

Partly, again, we may judge by the depth to which the needle penetrates before reaching the fluid. But this, also, is an ambiguous test, for not seldom the liquid in the distended ventricles comes so near to the surface as to seem to be immediately beneath the dura mater.

There is one positive indication, when it occurs, that the dropsy is ventricular, which I have learned from the comprehensive lectures on this subject, delivered before the College of Surgeons by Professor Prescott Hewett. He points out, what I mentioned a few minutes since, the effect of the pressure of the fluid collected within the skull, in flattening or pushing outwards the orbitar plates of the frontal bone. This happens in ventricular hydrocephalus alone; but it does not always happen. Now this change in the orbitar plates narrows the dimensions of the orbits, thrusts the eyeballs more or less out of their sockets, and gives them a downward direction; so that a great part of the pupil is hidden behind the lower lid, and the white of the eye is more uncovered and visible than is usual. When this condition of the eyeballs is noticeable in a hydrocephalic patient, you may be sure that the dropsy is ventricular. But there may be ventricular hydrocephalus without this outward token of its situation. The orbitar plates are not always warped. Whether they are so or not will depend upon circumstances, and one of the determining circumstances probably is the period at which the dropsical accumulation and pressure commence.

I once got a surgeon to perform the operation of tapping upon the infant of a poor woman, after I had tried in vain all the other measures that I have spoken of. To our horror, when the trocar was withdrawn from the canula, instead of clear serosity, a fine stream of purple blood spouted forth. The opening was at a considerable distance from the longitudinal sinus; but the trocar was not so fine as it might have been, and I presume that one of the larger superficial veins had been pierced. I do not think, either, that the instrument was introduced in a sufficiently perpendicular direction. Of course the risk of hitting a vein is increased when the trocar is carried obliquely inwards: and a large portion of the cerebral mass is also wounded. We naturally thought it was all over with the child, which presently became deadly pale and faint. A verdict of *infanticide by misadventure* stared us in the face. But under the use of stimulants the infant revived again; no hæmorrhage went on internally, as we apprehended it would; but the child, after a day or two, seemed very much the better for the loss of blood. This amendment, however, did not last; and the mother, who had been terrified by the immediate consequences of the operation, feared to come near me, lest I should wish to have it repeated; and at length our patient died. I was very desirous to examine the interior of the head; but this was not permitted.

On one subsequent occasion I have witnessed the operation. The subject of it was an infant about eight months old. Four months after its birth, its head was observed to grow inordinately large. At the time of the operation the fontanelles were exceedingly tense; the child screamed frequently, occasionally vomited, and was slightly convulsed; the features were pinched, and the eyeballs distorted downwards; but the pupils were not dilated. Four ounces of transparent liquid were let out by puncturing the anterior fontanelle. A few hours afterwards the child was tranquil, and much improved in aspect; the distortion of the eyeballs had disappeared. Three ounces more were taken away the next day. For two days thereafter all the symptoms appeared to be mitigated: but the skull was flaccid; yielding, like a cracked egg, to the gentlest pressure. On the evening of the fourth day after the first tapping, the respiration became hurried, the child grew dull, and, before midnight, expired. In this case it appeared to me that the chance of success was baulked by the want of external support subsequently to the tapping.

You will not expect me to draw any comparison between the merits of compression and of tapping, as substantive remedies. They are opposite measures, and adapted to different and opposite conditions of the brain. The one repairs defect of pressure; the other relieves its excess. To hold the balance even requires much care, a steady and gentle hand, an accurate judgment, and incessant vigilance. Either expedient may suffice, alone. Both may be (and have been) beneficially employed in the same case, in succession, according to its varying circumstances. If the walls of the head be tight and firm, the trocar should precede the bandage; if lax and moveable, compression should be cautiously tried, and followed, if need be, by the puncture.

When adverting, in a previous lecture, to the radical cure of hydrocele, I remarked that in other forms of dropsy we scarcely dared to employ, with the same view, the injection of irritating substances into the emptied cavity: but, in so saying, I underrated the hardihood of operative surgery. To cure chronic hydrocephalus in a radical manner, preparations of iodine have been thrown into the tapped skull. In one instance, not only was such fluid injected, but in order that it might be brought into contact with the whole internal surface, the poor child's head was shaken, as one might shake a phial. In another case no fewer than twenty-one injections were practised; and from first to last, not less than a drachm and a-half of iodine, and four drachms and a-half of the iodide of potassium, were thrown in upon the brain. Both arachnoidean and ventricular hydrocephalus have been thus treated. It is very surprising that these rude handlings of one of the most delicate textures of the body should have been apparently so harmless. If, however, they have hitherto inflicted no palpable injury, neither have they effected any permanent good. In one example the head was tympanitic after the operation; in more than one, the dimensions of the skull diminished somewhat for a time; in none did any signs of inflammation ensue.

All this (as Mr. Hewett observed) merely shows what some children will bear.

I have now done with the *inflammatory* affections of the *encephalon*: in conjunction with which I have also considered some other morbid conditions, that are either connected with inflammation of the contents of the cranium, or resemble it in some of their phenomena. Thus, I have spoken of *delirium tremens*, which is apt to be mistaken for inflammation of the brain: of *softening from disease, or occlusion, of the cerebral arteries*, which is liable to be confounded with inflammatory softening: of *tumours* of different kinds, which tend to produce inflammation, or symptoms like those belonging to inflammation: and of *chronic hydrocephalus*, which sometimes is the sequel, sometimes the precursor, of acute hydrocephalus; and has other points of analogy with that disease, the encephalitis of strumous children.

Before I take up the subjects of apoplexy and of palsy, I wish to direct your attention to the inflammatory conditions of the *spinal cord.*

The whole pathology of this portion of the nervous system is extremely interesting, but in some respects intricate and puzzling. In addition to those many difficulties, with which I showed you in a former lecture, that the entire subject of the diseases of the nervous apparatus is surrounded, there is this further obstacle to the general and diligent study of the structural changes of the spinal marrow—that much labour and expenditure of time are required for laying open the interior of the vertebral canal; which is, therefore, too often neglected in examining the dead body.

There are certain points in the anatomy and physiology of the spinal cord, which it is necessary that you should bear in mind, if you would have any clear notions of what has been learned in regard to its pathology. Let me repeat then that,

1. In the first place, the spinal cord (including the medulla oblongata) is the seat and centre of that remarkable property, the reflex function; by which so many of the automatic movements of the body are regulated.

2. Not only is it in itself a distinct and well defined centre, but it is also an intermediate conducting organ between the brain and the nerves, transmitting centripetal and centrifugal influences; sensory impressions from the surfaces of the body, and motor impulses from the encephalon.

3. In order that we may feel, or be conscious of, what occurs in any part of the trunk or limbs, it is necessary that there should be a continuity of nervous matter between that part and the sensorium; and in order that our will to move any such part should be obeyed, the continuity must extend to the cerebrum. If the cord be cut across at any point, or so crushed as to be thoroughly disorganised at that point, a complete abolition of sensation and of *voluntary* motion ensues in all those parts of the body that receive their sentient and motor nerves from that portion of the cord which lies beyond the place of the injury, reckoning from the brain. What is true in this respect of the mechanical division of the cord, is equally true of such local disease as pervades and spoils the nervous matter composing it at any point.

Now it follows from this, that the effects of disorganising forms of disease—as well as the effects of injuries—must vary greatly according to the part of the cord they occupy.

Thus any such disease or injury affecting the whole breadth of that portion of the spinal marrow which is contained within the upper cervical vertebræ, is inevitably fatal at once; producing suffocation by paralysing those muscles through the play of which the motions of respiration are performed. You know that the intercostal muscles and the diaphragm have at all times the main share in carrying on the mechanical actions of respiration; and probably they execute the whole action in every case of ordinary breathing. Now the intercostal, as well as their ancillary superficial muscles, are furnished with motor nerves from the spinal cord, all along the dorsal vertebræ; and the diaphragm is principally supplied by the phrenic nerves, which are chiefly derived from the third and fourth cervical nerves, and probably have their origin in the cord near the medulla oblongata. These muscles obey the will; but they act also independently of the will. The pneumogastric and trifacial nerves, with respect to them, are excito-motor nerves, and call into play a reflex power which is transmitted from the medulla oblongata. Hence any profound injury of the spinal cord, above the exit from it of the phrenic nerves, stops both the voluntary and the involuntary movements of the respiratory muscles; and the individual perishes by apnœa, in as strict a sense, as though the access of air to the lungs had been suddenly prevented by a ligature drawn tightly round his windpipe.

Again, when a segment of the cord, however small, is disorganised throughout in its cervical part, between the exit of the phrenic and the exit of the upper intercostal nerves, the breathing is not instantly suspended; but is performed entirely by means of the diaphragm, the intercostal muscles having no share in it. The ribs cease to rise and fall; and the abdomen is alternately protruded, and sinks back again. In each case I suppose the disease of the cord to be such as suffices to paralyse the parts supplied with nerves that issue from it, beyond the seat of the disease. If disease of this kind occur below the giving out of the intercostal nerves, the breathing is not affected; we have *paraplegia* only, palsy and loss of feeling in the lower extremities, and perhaps in the hips, or even higher. Now a person in this condition *may* live a long time. When the disease is situated between the issue of the intercostal nerves and the issue of the phrenic, he may live a few days, but he seldom lives a week, and never survives a month; and when the disease is higher still, in the very upper part of the cord, above the issue of the cervical nerves, he perishes outright. The *kind* and *degree* of disease, therefore, being the same, the character of the symptoms, and the amount of danger, differ remarkably, according to the *seat* of the disease.

4. Although sensation and voluntary motion cease upon the disruption of the communication with the encephalon, the excito-motor functions of the separated portion of the cord are not necessarily suspended. On the contrary, they seem to acquire increased activity. The automatic power is apt to run riot, as it were, when the controlling influence of the parts above it is withdrawn. All of you probably have seen the limbs of a

recently decapitated frog thrown into violent action by the stimulus of galvanism. I have witnessed the same thing in the human body after death by hanging. What is still more curious and conclusive, you may have unequivocal manifestations of similar phenomena in the *living* body. Dr. William Budd has described in the 22nd volume of the 'Medico-Chirurgical Transactions,' a very interesting case in which a man was afflicted with paraplegia, in consequence of disease of the vertebral column. He was totally deprived of the power of moving his lower extremities. Sensation in them was almost, yet not entirely, extinct. A sharp pinch, or the prick of a pin, he could feel; but slight friction he was quite unconscious of: yet (as he himself said) his limbs were not; for when the inner edge of the foot was brushed or tickled by the hand of another person, the corresponding leg, over which he had no voluntary control, would start up, and be briskly convulsed. The same thing took place, in both limbs, whenever he passed his urine or fæces; so that he was obliged to have an apparatus of straps and ligatures to keep the legs down on such occasions. I have seen something like this myself, in several instances.

5. Since the first publication of the late Dr. Marshall Hall's sagacious researches, the physiology, and with it the whole pathology, of the spinal cord has been undergoing a complete reformation. I know of no modern discovery so fruitful of important practical consequences, or so likely to improve our remedial management of many nervous disorders, as the singularly interesting truths which many, following in his steps, are even now engaged in demonstrating and enforcing. I do not profess to teach you this new physiology. I touch only, as I pass along, upon some of its cardinal points, to which I may have occasion to refer in future. We are considering how the signs of spinal disease may vary according to the particular seat of that disease; and I would have you remark, here, that inasmuch as all the acts of ingestion and expulsion, all the inlets and outlets of the body are governed by the spinal marrow, with its corresponding apparatus of incident and motor nerves—it is to be expected that disease in the upper part of the true spinal system should affect the orifices which answer to that part, and which are principally inlets—the larynx, the gullet, the cardia: while disease in its lower portion will be likely to disturb the natural functions of the lower orifices—the rectum and anus, the bladder and urethra, the os uteri—which are chiefly outlets.

6. You must bear in mind also the grand discovery of Sir Charles Bell, that the two roots by which each spinal nerve arises have distinct and different functions.

When it had been fairly made out that the anterior *roots* were composed of motor fibrils, and the posterior of sensiferous, it was naturally inferred that the anterior *columns* of the spinal *cord* were subservient to the purposes of motion, and the posterior to the faculty of sensation. But this was an erroneous inference. Later anatomical researches, those especially of Dr. Lockhart Clarke; and experiments made upon living animals, the experiments in particular of Dr. Brown Séquard, concur with the results of clinical observation to prove that the posterior white columns are *not* the channels of sensation. Sensibility has remained perfect when these columns were thoroughly disorganised. It is probable, from their relations with the cerebellum, that a part at least of their office concerns the coordination and regulation of the muscular movements of the body.

The antero-lateral columns are doubtless the channels of the motor power, while sensory impressions seem to be somehow conducted through the gray substance of the cord.

It is a curious fact, elicited by clinical experience, that in disease of the cord, not involving the roots of the nerves, the power of moving the limbs is commonly earlier and more diminished than their sensibility.

Sometimes it happens that sensibility, or voluntary motion, or both, are impaired in the upper extremities, while the same functions remain perfect in the lower and more distant limbs. In explanation of this phenomenon it has been supposed that distinct and different filaments of the spinal cord, extending from its junction with the encephalon, connect themselves with or help to form the several nerves which emerge from the cerebro-spinal axis; and that intra-cranial or intra-spinal disease has spared those strands and fibres which pass down to the nerves given off at the inferior part of the spine, while it has affected those strands only which belong to certain nerves from the superior part.

But a similar limitation of paralysis to the upper limbs may result from the implication of the *roots* of the spinal nerves, in disease of the upper segments of the cord itself or of its membranes. And it is a fact worth remembering, and certified both by physiological and pathological observation, that irritation or disease affecting the roots of the upper cervical nerves may cause inequality in the pupils of the eyes, and suggest suspicion of mischief within the head, when the disorder is purely spinal.

7. We must not forget that the brain, and the spinal cord, which are distinct from, but yet continuous with, each other, sympathise largely and mutually under disease. This circumstance throws an additional obscurity over the study of their morbid conditions. It is one, however, which we cannot avoid, but which we must estimate and allow for, in our observation of diseases, as we best may.

8. There are a few remarks made by Dr. Abercrombie, in relation to some of the anatomical dispositions of the cord and its investing membranes, which may help us to comprehend better some of their morbid contingencies. Thus, with respect to the dura mater of the cord, it is practically of importance to recollect 'that it adheres very slightly to the canal of the vertebræ by a very loose cellular texture: and that it adheres very intimately to the margin of the foramen magnum. In this manner a cavity is produced betwixt the membranes and the inner surface of the spinal canal (external, i. e., to the membranes), which cavity may be the seat of effusion, and which has no communication with the cavity of the cranium. On the other hand, the space between the dura mater and the pia mater (or membrane immediately covering the cord) communicates freely with the cavity of the cranium; so that fluid may pass easily from one to the other, according to the position of the body.'

I shall pursue the same order, in speaking of the inflammatory affections of the spinal cord, as I followed in regard to the analogous conditions of the encephalon. And, first, let us enquire what has been noticed of inflammation of the *membranes* of the cord. They may undergo inflammation, independently of the substance of the cord, and independently of the brain; but this is not very common. Usually, when we have meningitis of the cord, we have the same disease also within the cranium: usually too, with meningitis of the cord, we have more or less inflammation of the nervous matter composing it. The commonest symptoms of inflammation of the meninges of the cord (for I do not pretend to speak of the several membranes separately) appear to be pains, often intense, extending along the spine, and stretching into the limbs, and aggravated usually by motion, and so far simulating rheumatic pains: rigidity or tetanic contraction, and sometimes violent spasms, of the muscles of the back and neck, amounting in some instances to perfect opisthotonos; a similar affection of other muscles also, as those of the upper or lower extremities: a sense of constriction in various parts, in the neck, back, and abdomen, as if those parts were girt by a tight string: feelings of suffocation: retention of urine: occasionally priapism: obstinate constipation: and with these symptoms, rigors often.

You are not to expect in every case all the symptoms which I have been enumerating: they will vary according to the seat and extent of the inflammation. We need not wonder at the spasmodic symptoms, when we recollect that the nerves which issue from the body of the cord receive a covering from its pia mater. The pain felt along the course of the spine itself is said to be increased by percussion of the spine, but not by simple pressure; and this seems very likely.

I know of no way in which I can so well hope to awaken an interest in you about these diseases, or to offer you instruction respecting them, as by instances. The following I take, abridging it somewhat, from Dr. Abercrombie. A man, twenty-six years old, had for several years been subject to suppuration of the left ear; undergoing occasional attacks of pain on that side of the head, which were followed by a more copious discharge from the ear. In the first week of April he became ill, with pain of the forehead and occiput, disturbed sleep, and loss of appetite; but no fever. At the end of the week he complained of pain extending along the neck. This pain gradually passed downwards in the course of the spine, and deserted the head; and at last, after many days, it fixed itself with intense severity at the lower part of the spine; shooting thence round the body towards the crests of the ilia. He became affected also with great uneasiness over the whole of the abdomen, and had much pain and difficulty in voiding his urine. About the end of the second week in April his sufferings had become extreme. He could not lie in bed for five minutes at a time, but was painfully restless; walking about the house in a state of great agitation, grasping the lower part of his back with both his hands, and gnashing his teeth with the intensity of his pain. He had no interval of ease, and was sometimes incoherent and unmanageable. On the 16th, he went to take a warm bath, walking down three stairs, and into an adjoining street, with little assistance. His speech afterwards became somewhat affected: there were convulsive twitches of his face, and difficulty of swallowing. Some transient squinting also was observed. The pulse was now very frequent. On the 18th, while sitting in a chair, he suddenly threw his head backwards with great violence, fell immediately into a state of coma, in which he remained for two hours, and then died. During the whole disease, there had been no paralysis, except the slight affection of his speech; no difficulty of breathing; no vomiting; and no convulsions except the twitching of his face the day before his death. The pulse was small and irregular. The bowels were easily kept open, but the pain in his back was much increased by going to stool. Two days before his death he had several attacks of shivering; and much purulent matter was discharged from his left ear during his illness.

Upon a very careful examination of his body, every part of the brain was found to be in a most healthy state. Some gelatinous deposit was found under the *medulla oblongata*; and purulent matter flowed, in considerable quantity, out of the spinal canal. The spine being entirely laid open, the cord was seen covered with a coating of purulent matter, which lay betwixt it and its membranes. The matter was most abundant at three places; at the upper part, near the foramen magnum —about the middle of the dorsal region—and at the top of the sacrum; but it was also distributed over the other parts with much uniformity. The substance of the cord was soft, and separated in some places into filaments. All the other viscera were healthy.

You may find several interesting examples of this form of disease in Ollivier's 'Treatise on the Spinal Marrow.' The most prominent symptom generally was *pain*, occurring by fits, with intervals of comparative or complete ease. The pain was referred to some part of the spine, and was almost always increased by the patient's movements. Often, indeed, it was not complained of at all except when movements were attempted. In general it extended also along some of the limbs, and was accompanied by muscular rigidity, or tonic spasms. Dr. Radcliffe is of opinion that the rigidity, in these cases, is not strictly tetanic; but the result of an instinctive contraction of the muscles, checking movements which would otherwise produce or aggravate the pain. Palsy occurred in one case; but this seemed to have been owing to *softening* of the cord itself. In the case that I have quoted from Dr. Abercrombie, the intense pain underwent no remission or abatement. In one of Ollivier's examples, there was, at the commencement of the disease, a periodic intermittence of the pain; it came on with intense severity at ten at night, and lasted till three in the morning.

The causes of spinal meningitis are not always to be discovered. It sometimes extends from within the cranium. It may be excited by external violence to the spine, of which a good specimen has been recorded by Sir Charles Bell:—A waggoner sitting on the shafts of his cart, was thrown off by a sudden jerk, and pitched upon the back of his neck and shoulders. He was taken to the Middlesex Hospital, where he lay for a week, without complaining of anything except stiffness of the back part of the neck. He could move all his limbs with freedom. On the eighth day after his admission he was seized with general convulsions and locked jaw. He then became affected with a singular convulsive motion of the jaw, which continued in violent and incessant movement for about five minutes. This was followed by maniacal delirium. He then sank into a state resembling typhus fever; and after four days was found to be palsied and insensible in his lower extremities. The day before his death he recovered sensation in his legs.

On dissection, a large quantity of purulent matter was found within the spinal canal. It appeared to have formed about the last cervical and the first dorsal vertebræ, and to have dropped down, by its own gravity, to the lower part of the canal; where it produced palsy and anæsthesia of the inferior limbs, probably by the pressure it occasioned.

Inflammation of the *substance* of the spinal cord, *myelitis*, leads to the same changes in its texture which have been already spoken of as being often the results, in the brain, of inflammation of the *cerebral* matter. Softening—induration—suppuration. I need not, therefore, again describe the physical characters of these alterations.

The symptoms which flow from inflammation of the nervous pulp of which the spinal marrow is composed, are by no means uniform; nor can we expect that they should be so, when we call to mind what has been already stated of the different effects that must ensue according as different parts of the cord happen to be implicated. The phenomena will vary likewise, according as the inflammation is acute or chronic. If we recollect how many parts of the body depend for their power of motion, and for their sensibility, upon the integrity of the spinal cord, we shall not be surprised at the diversity and multiplicity of the symptoms produced by disease of the cord.

Tracking inflammation and its events from the upper portion of the spinal marrow downwards, we should expect to find, and we actually do find, some such an arrangement of symptoms as the following:—Convulsive affections of the head and face, inarticulate speech, loss of voice, trismus, difficult deglutition, spasmodic breathing, irregular action of the heart, constriction of the chest, vomiting, pain of the belly, sensation of a cord tied round the abdomen, numbness and tingling of the limbs, dysuria, retention of urine, incontinence of urine, priapism, constipation, tenesmus, involuntary stools: and with respect to the voluntary muscles corresponding to these parts of the spinal marrow, palsy, mostly of the paraplegic form, and sometimes, but not very commonly, preceded by convulsions.

I must again have recourse to examples, to put you, more fully than any attempted abstract picture could put you, in possession of such forms of inflammation of the cord as you may expect to meet with in practice.

A man, fifty-six years old, was exposed to severe cold, while travelling on the outside of a coach. After this he was attacked with pain in the right arm and leg, most acute about the shoulder, but affecting the whole side, and he had also much headache. He soon perceived some loss of power in the affected limbs; and the progress of this was very curious. It began at the upper part of the arm, and extended downwards so gradually, that he was able to *write* distinctly, after he had lost the power of raising the arm or bending the elbow. Then the leg became affected in the same gradual manner, and after ten or twelve days from the commencement of the disease, the whole leg and arm had become completely paralytic. Some pain continued in the parts, and it was occasionally severe, especially in the leg. Repeated blood-letting, and purgatives, and blistering, were employed. His mind remained quite entire. His pulse was 84, and rather weak. After some time the *left* arm became paralytic, rather suddenly; but it was not so completely motionless as the limb on the right side: the left leg was not at all affected. Slight delirium occurred, but passed off again. At the end of two months after the exposure to cold, he again became delirious, and his pulse got feebler and rapid: he then fell into a state of stupor, muttering incoherently, but answering questions distinctly when he was roused. He lost his speech a few hours before death. For the last eight or ten days there had been considerable sloughing of the sacrum.

The brain was found to be healthy throughout. Much bloody fluid was discharged from the spinal canal into the cavity of the cranium before the spine was laid open. On displaying the spinal cavity itself, the cord was found in a state of complete softening, from the second to the last cervical vertebra. The portions above and below that part were quite healthy. (ABERCROMBIE.)

Comparing this case with the one I detailed of meningitis, we find that pain was present in both, but more severely so in the case of inflammation of the membranes: we find also, that stiffness and spasm of the muscles marked the *meningitis*; palsy, *the inflammation of the substance of the spinal cord.* In neither of them were the intellectual functions disturbed till towards the last. I believe that the characters now pointed out belong to these forms of disease respectively.

I borrow the following example (abbreviating it) from an interesting collection of *Cases of Paraplegia*, published by Dr. Gull.

A healthy brickmaker, twenty years old, walked twenty-eight miles on July 18, 1855, in search of work, and slept in a brick-field. On the next day, which was close and wet, he walked thirty-two miles, and allowed his wet clothes to dry upon his body. On the 20th his legs suddenly gave way under him, and he fell down; but he got up again, and walked from his garden into his house, and two hours afterwards upstairs to his bed, feeling all the time 'pins and needles' from the thighs to the feet. Retention of urine then came on, and his bowels ceased to act. On the 26th there was complete paraplegia, with involuntary twitchings and spasms of the legs, and gradually increasing anæsthesia below the navel, but nowhere complete. The motions of the lower ribs were imperfect. He had no priapism, no sense of tightness round the waist, and scarcely any pain. Slight movements of the legs could be produced by tickling the soles of his feet, and these movements were more readily excited as the case advanced. The retained urine became ammoniacal; sloughs formed over the sacrum; and he died exhausted, without any delirium, on August 20.

There was no adhesion between, nor effusion of lymph upon, the spinal membranes, which had an anæmic appearance. At the middle of the dorsal region there was marked softening of the cord with slight enlargement for two or three inches. The posterior columns were quite diffluent, and contained exudation granules, to an extent much greater than was indicated by the softening visible to the naked eye. The anterior columns were softened, but retained their form. Both columns were of an opaque white colour; the gray matter was mottled by injection of its vessels.

Here again, the cord being affected and the membranes untouched, we have palsy, with scarcely any pain, and no disturbance of the mental functions.

Much may be learned in regard to the effects of inflammation, or any other cause of disorganisation, *confined to a limited portion of the cord*, by observing what takes place in those injuries in which the bones of the vertebral column are broken or displaced. Of course I do not dwell upon these accidents, for they belong to surgery: but I have seen a good many of them, and watched them with deep interest. The symptoms are much more uniform than when inflammation occurs within the vertebral canal independently of external injury; simply because the injury to the cord is more definite and local. But such cases are very valuable objects of study to the physician. I remember several that occurred when I was a dresser in St. Bartholomew's Hospital; and I will state very briefly the particulars of one, as an example. In the year 1820, a man was brought there who had been thrown out of a tilt cart, in consequence of a dray's running foul of it. He had pitched upon his head, which showed, however, no trace of injury. When picked up he was found to be powerless, both in the upper and lower extremities. His stools passed from him without his being aware of it, and it was necessary to use the catheter to empty his bladder. He breathed entirely by the diaphragm—that is, his thorax was motionless, and his abdomen rose and fell with every alternate act of inspiration and expiration. These symptoms are perfectly distinctive of injury to the cord between the origins of the phrenic and intercostal nerves. He suffered pain about the middle part of the neck behind. He went on exceedingly well for four or five days, and then the nurse very foolishly acceded to his request to be turned on his side, which caused his death in a very few minutes. This is not the only instance that I have known, in which life has been suddenly extinguished by similar imprudence. The lesson may be useful. There was another patient in the same hospital, who had fractured the cervical portion of the spinal column. Among other remedial measures, the surgeon had directed that his head should be shaved. The barber had performed half his task, and was turning, with his hands, the unfortunate man's head into a more convenient position for completing it, when he suddenly expired. The twist was fatal to him.

On the examination of the body of the patient whose case I was mentioning, a very remarkable state of the spinal column was found. The fifth and sixth cervical vertebræ were dislocated from each other *without any fracture*; a thing which has sometimes been pronounced impossible. The articular processes were fairly separated; and the vertebræ were also forced asunder, by the detachment of one of them from the intervertebral substance. The nervous matter of the cord opposite the point of dislocation was quite soft.

There is one very common and distressing consequence of such disease of the spinal marrow as produces paraplegia, not particularly noted in any of the cases which I have related, but always to be looked for. The muscles by means of which the bladder empties itself, are liable to participate in the palsy; and then the bladder empties itself no longer. The urine accumulates in it, and distends it, and even the ureter becomes dilated; and in this way not only the present but the prospective danger is increased. For the foundation of future disease in the kidneys is often thus laid, even when such distension of the bladder by its retained contents occurs independently of any disease of the spine; as it may do from stricture; from enlargement of the prostate; or even from the voluntary retention of the urine beyond a certain period, through feelings of delicacy. You are to look out, I say, for this distension of the bladder, and relieve or prevent it by the introduction of a catheter through the urethra. You must not be deceived by being told that the patient passes plenty of water; that it even runs from him. Incontinence of urine is, in fact, in these cases, though it may sound paradoxical, a sign of retention of urine. The urine dribbles away because the bladder admits of no further distension; it overflows, and runs out at the natural orifice, but the bladder remains constantly full and stretched. You must make an examination, therefore, of the hypogastric region with your hand. If you find that part of the belly hard and resisting, and giving out a dull sound on percussion, you may be sure, in these cases (where there is paralysis of the lower extremities, and the water dribbles away), that the bladder is full, and has lost the power of expelling its contents. Sometimes you may recognise the fluctuation of the urine in the distended bladder, and ascertain the globular shape of that organ. It may rise even beyond the umbilicus. But what I chiefly wish to point out to you is the circumstance that the bladder becomes diseased, and the urine altered in quality, under this state of palsy. The urine grows alkaline, turbid, and ropy, and exhales a very offensive ammoniacal smell; and the inner surface of the bladder is found, after death, to be thickened, red, and smeared with adhesive puriform mucus—in a state of chronic inflammation in short.

LECTURE XXIII.

Inflammatory and Structural Diseases of the Spinal Cord, continued. Treatment. Use of the Ophthalmoscope for Diagnosis. Apoplexy. Its General Symptoms and Diagnosis. Symptoms characterising the Apoplectic State. Pressure the ordinary Physical Cause. Hemiplegia.

Allow me to repeat that the structural diseases of the spinal cord will reveal themselves, by their symptoms, most clearly to him who most distinctly perceives, and most accurately bears in mind, the *physiology* of that part of the nervous system. But to the best informed, and the most sagacious, they are too frequently obscure and perplexing.

Disease occupying a portion only of the cord, but affecting the *whole thickness* of that portion, from centre to circumference, will be likely to disturb, or suspend, the functions of sensation and voluntary motion in all the parts supplied with motor or sentient nerves from that portion of the cord, and from the portions beyond it. So that a great variety of symptoms depend, when the *amount* of disease is the same, upon the *place* of the disease. A total interruption of the conducting function of the cord, in the neck, above the issue of the phrenic nerves, extinguishes life by stopping the actions of respiration. A similar interruption in the cervical part of the cord, above the issue of the intercostals, but below the issue of the phrenic nerves, destroys life as certainly, but not so rapidly, nor in exactly the same manner. We find the lungs loaded with frothy serous fluid in such cases; we find the bladder inflamed; and, often, sloughing of the integuments and muscles of the nates and hips. A similar interruption below the dorsal vertebræ is not *necessarily* fatal, even when it is attended with permanent paralysis: but it *usually* is so, sooner or later.

When the interruption of function is not total and complete, disease of the cord will be likely to produce rigidity, convulsions, tremors, or simple weakness, of the corresponding muscles; pain, tingling, numbness, of the corresponding limbs and surfaces.

The spinal cord is a symmetrically double organ, and disease limited to one of its lateral halves will derange or abolish the power of movement in the corresponding muscles *on the same side of the body alone*; and perhaps disturb somewhat the sensations of that side. But the experiments of Dr. Brown Séquard appear to prove that there are sensiferous fibres proceeding upwards and downwards from the posterior roots of the nerves; and that these sensiferous fibres decussate each other within the cord. If this be admitted as an anatomical truth, it explains what was formerly a perplexity, namely, that paralysis of one side of the body, without anæsthesia, is sometimes associated with anæsthesia of the other side, without paralysis. In this severance of palsy and defective sensibility, may we not find one clue to the special diagnosis of hemiplegia that is strictly spinal, from hemiplegia that is cerebral in its origin?

The same anatomical disposition enables us also to comprehend how the complete division, in a living animal, of the spinal cord into its two lateral and symmetrical halves, by an incision carried through the median line between them, may destroy sensation on both sides of the body without producing paralysis of either side.

If you impress upon your recollection the facts thus summarily stated, you will find in them, I think, a key to many of the phenomena which accompany, and denote, more or less plainly, disease of the spinal marrow.

Inflammation of the *membranes* of the spine is most apt to declare itself by *pain*, increased on motion, of the spine and of the limbs; and by *rigidity and spasm* of the muscles of the neck and back. Inflammation of the *cord* itself, which readily passes into, or rather produces, softening of its substance, is most commonly marked by palsy of some parts of the body, with or without anæsthesia; and sometimes, but rarely, preceded by convulsive movements. The same may be said of *suppuration* when it occurs as an event of inflammation; and the pus may be collected into an abscess in the nervous matter of the cord, or it may be diffused and mixed with softening.

Now I need not dwell upon the *treatment* proper to be adopted in inflammation of the spinal cord and its membranes. *Mutatis mutandis*, it is the treatment already recommended in inflammation of the encephalon and *its* membranes. When the inflammation is acute, blood should be taken by leeches, or by cupping glasses, applied along the sides of the spine. Perfect rest in the horizontal posture must be strictly enjoined.

In more chronic forms of inflammation within the spinal canal, we have still a capital remedy in cupping: and counter-irritation in various ways, but more especially by means of issues made on one or both sides of the spinous ridge, is also, in many cases, of most essential and unquestionable service. Mercury will sometimes be an eligible remedy; especially whenever there is reason to suspect that the inflammation, whether acute or chronic, has a syphilitic character.

Great care must be taken, when there is palsy of the bladder, not only (as I admonished you in the last lecture) that the urine be regularly drawn off, but also that the patient be kept *dry* and *clean*; for if great attention be not paid to this point, sores will form where the urine remains in contact with the skin, to the great increase of his suffering, and of his danger. Indeed, take what pains we may, there is generally a strong disposition to the formation of sloughs upon the sacrum and hips in cases of paraplegia. They result from the perpetual pressure made upon those projecting points; from the feeble state of the circulation in the palsied parts; and (often) from the irritation of the urine and fæces, which are passed without the sufferer's consciousness.

When the patient is kept clean and dry, and the surfaces on which the weight of his body has been supported begin to be red and angry, you may protect them by a plaster: or by rubbing them with brandy you may sometimes prevent the skin from breaking: or, what is best of all, you may put your patient upon one of Dr. Arnott's hydrostatic beds; and then the pressure will be equally distributed over all that portion of the body which comes in contact with the waterproof material of the bed.

To bring this outline of the diseased states of the spinal cord up to that point in which we left those of the encephalon, I may state that, like the brain, the spinal marrow may become hardened by chronic inflammation; and, like the brain, it may be encroached upon by tumours; fibrous, scrofulous, or malignant. With respect to these, all that I can now say likely to be of any practical benefit to you, is that the symptoms they occasion are those of slowly increasing paralysis, or of slowly increasing rigidity of the muscles, or of their gradual and progressive waste, without fever or what is called reaction; and that the locality, and extent, and effects of the paralysis, or of the rigidity, or of the wasting, will vary according to the part of the cord in which these morbid conditions occur, and the depth to which they affect it.

I must here say a few words about an avenue to the diagnosis of brain diseases which is of recent discovery, and of great importance.

I told you, the other day, that the contents of the living cranium were inscrutable by our bodily senses; could neither be seen by us, nor heard, nor handled.

But, in strictness of speech, this assertion has ceased to be absolutely exact.

Passing by the alleged possibility of ascertaining certain conditions of the intercranial circulation by some sort of auscultation of the skull, I must admit that a window has been found through which a small off-set, or sample, as it were, of the brain may easily be inspected. Helmholtz's lately perfected instrument, the ophthalmoscope, enables us to survey, by reflected light, the whole interior of the eye, and to bring distinctly within our vision the beautiful arrangement, and the varying conditions, of its living inner structure. The retina may almost be regarded as a piece of the brain displayed at an aperture in its bony covering; or, at any rate, as an index or dial-plate upon which are inscribed tokens of some of its morbid states. It is fed by branches of the same blood-vessels, vessels that are furnished also with the same vaso-motor nerves: the character of its circulation, therefore, partakes of, and so far reveals, the character of the deeper-seated circulation within the brain-case.

Mr. Bowman has assured me that the ophthalmoscope has contributed nothing less to our knowledge of the diseased conditions of the interior of the eye, than the stethoscope has of those of the chest; and Dr. Hughlings Jackson makes a similar estimate of its comparative value for unravelling the complex symptoms of diseases of the brain.

I do not pretend to any familiar acquaintance with this instrument, but I may tell you that it shows, at the bottom of the eye, in health, a round space, called the *optic disc*, of definite boundary, and of a yellowish-red colour, whereon may be plainly seen and distinguished from each other, the veins and arteries of the part, their course and distribution.

In certain forms of cerebral disease this disc undergoes specific changes. Its rim loses its clear sharp outline, becomes obscure, or sometimes ragged. The colour of the disc grows fainter, pale, white; its blood-vessels diminish in size, and there is often a scattering of white pigment in its neighbourhood. This state Dr. Hughlings Jackson calls 'white atrophy of the disc,' and believes it to be the result of inflammation; of *optic neuritis.*

Unnatural paleness of the disc may, however, be the effect of simple anæmia.

Sometimes, again, the surface of the disc becomes hazy, tumid, bloodshotten, or of a dirty red colour: its separate vessels are effaced or blurred; its margin is indistinct and lost in the fundus of the eye, and the disc itself appears to be enlarged. This 'woolly' condition implies neuritis.

These alterations denote the kind, though not the place, of various morbid states of the brain: the presence of syphilitic disease; of Bright's disease; and of others. They imply also impairment of the patient's vision, more or less of amaurosis; but it is curious that the blindness is often less felt by the patient than the changes manifest in the retina might lead us to expect. I advise you to lose no opportunity, while you are *in statu pupillari*, of making yourselves familiar with the sound and the unsound aspects of this significant disc. It is an advantage new to the present generation.

I proceed, in the next place, to a perfectly distinct class of diseases of the brain and spinal cord; to the apoplectic and the paralytic affections, arising independently of inflammation. It will be convenient to consider these disorders together. Apoplexy may indeed occur without paralysis, paralysis without apoplexy; but the two so frequently coexist, or happen in such immediate sequence and connection, and in their history and pathology they have so much in common, that we shall best understand the whole subject by comprehending them in the same review.

When a person falls down suddenly, and lies without sense or motion, except that his pulse keeps beating, and his breathing continues, he is said to have been attacked with *apoplexy.* He appears to be in a deep sleep; but this is not all, for you cannot awaken him by the same means which would rouse a healthy man. He is not in a state of syncope, for his pulse beats, perhaps with unnatural force; and often his face, instead of being pale, is flushed and turgid, and his respiration goes on, though it may be laboured and stertorous. What I now denominate apoplexy, is the very same state which has so frequently been mentioned already in these lectures; it is *coma* occurring suddenly, or coming on (at least) with rapidity.

What is coma? it is that condition in which the functions of animal life are suspended, with the exception of the mixed function of respiration; while the functions of organic life, and especially of the circulation, continue in action. There is neither thought, nor the power of voluntary motion, nor sensation: but the pulmonary branches of the par vagum continue to excite, through the medulla oblongata, the involuntary movements of the thorax. When this upper part of the cranio-spinal axis becomes involved in the disease, and its reflex power ceases, the breathing ceases also, and the patient is presently dead.

It is a common question—how would you distinguish apoplexy from the effects of a narcotic poison? If you were summoned to a person in the state I have been describing, how could you tell whether he was afflicted with apoplexy from disease, or was stupefied by a large dose of opium, or merely dead drunk? Why, so far as the condition of the cerebral functions is concerned, you often cannot discriminate the one from the other. In each case there is profound coma: but the cause of the coma is different in each, and you must seek to ascertain that cause in the history and other circumstances of the patient. If, indeed, any *one-sided* symptoms concur with the coma—twitchings of the muscles, for instance, on one side only; minute contraction of the pupil of one eye only—you may pretty confidently ascribe the coma to brain-disease. Again, if the patient can be roused, even for a moment or two, so as to give intelligent replies to questions, the case is probably one of poisoning by alcohol, or by opium. You enquire whether he is known to have been drinking, you try if you can perceive the odour of alcohol, or of wine, in his breath; or you endeavour to make out whether he has been low-spirited, or in known difficulties; in short, whether it is likely that he may have swallowed poison. But from the actual condition of his sensorial functions alone, you cannot solve the question.

Yet let me say, thus in the outset of our remarks upon apoplexy, that it is often of great importance that the diagnosis should be determined. A man was found lying in Smithfield in a state of total insensibility, and motionless, except that he still breathed. He was carried into St. Bartholomew's Hospital. The house-surgeon thought he smelt the smell of gin in his mouth; and thereupon very properly made use of the stomach-pump. By means of it he discharged a large quantity of ardent spirit; and in the course of a few minutes the man revived, shook his ears, and walked away. If the gin had been suffered to remain in the stomach, and if some of the customary remedies of apoplexy had been vigorously put in force, the absorption of the poison would have been thereby accelerated; and the debauch would probably have had a fatal termination. The same remarks apply still more urgently to the case in which opium, or any other strong narcotic poison, is lying in the stomach. Even when there is no great danger, either in the person's condition, or in the remedies used for it, it is not a very pleasant or creditable thing to make a false point of this kind. If we do err, however, we had better err on the safer side. The father of the late Professor James Gregory of Edinburgh (who used to relate the case in his lectures), was once called out very late in the evening to visit an old gentleman of that city. He found him in a completely comatose state; his wife crying, and all his household plunged in grief and distress. They told him that the patient, whom he now saw in a fit, had come home, and upon a servant's opening the door to him, had fallen into the passage, on his back, in a state of insensibility. Dr. Gregory learned, however, that he had been at the 'Club,' and he knew well enough that this club was composed of choice spirits, fond of their cups; although the gentleman's wife did not know so much. Therefore he ventured to express his 'hopes' to the wife that her husband was drunk: a charitable view of the case, at which she was extremely affronted and indignant. He persisted, however, in his opinion, and not long afterwards the patient began to recover his senses. It turned out that he had partaken more liberally than the rest of the club, and was the *first* to be intoxicated. Two of his companions carried him home quite incapable of motion; but not liking to introduce him themselves to his wife in that predicament, they placed him with his back against the door, rang the bell, and decamped. Of course, when the servant came to open the door, his master tumbled senseless on the floor. I need not point out to you what ridicule the physician would have brought upon himself, and what damage he might have inflicted upon his patient, had he busily applied, in this case, the ordinary remedies of apoplexy.

The state of coma, such as I have described as being characteristic of apoplexy, may terminate in one of three ways. It may cease, more or less rapidly, and leave the patient to all appearance in perfect health. What may be the exact condition of the encephalon during the continuance of the coma, in such cases, no one can positively tell. But the occurrence of temporary coma, under the influence of a narcotic poison, and the perfect disappearance of the coma as the effects of the drug pass off, teach us that the functions of the brain may be almost totally suspended for a time by causes which do not injure its texture. I think it possible that, when there is no poison at work, a temporary stress upon the cerebral blood-vessels (produced by a determination of blood towards the head, through the arteries, or by a detention of blood in the obstructed veins) may exercise a degree of pressure upon the central parts of the brain sufficient to cause transient coma.

But often there *is* poison at work, an inbred poison, of which the agency was not recognised until a comparatively recent period; the poison of unpurified blood. When speaking of the general pathology of dropsy, I mentioned a peculiar renal disease—first detected and described by our distinguished countryman Dr. Richard Bright—which unfits the kidney for what is probably its most important office; that of removing *urea* from the system. When this excrement, thus retained, accumulates in the blood beyond a certain amount, it is very apt, among other injurious tendencies, to cause death in the way of coma, which is then said to be *uræmic*. The retention of bile, or of some of its principles, has occasionally, as it would seem, a similar consequence. In all cases, therefore, of apoplectic stupor, you must not omit to search for evidence of this source of the coma.

In the second place, the apoplectic coma may terminate, more or less quickly, in *death*. And on examining the brain we may find a large quantity of extravasated *blood* spread over its surface, or lying within its broken substance: or a considerable effusion of *serous fluid* collected within its ventricles: or we may detect *no* deviation whatever from the healthy structure and natural appearance of the organ. The congestive pressure (if it indeed existed) has left no prints of its action.

Dr. Abercrombie has given to that form of apoplexy, which destroying life, leaves no traces behind it, the name of *simple* apoplexy. And this name, for its convenience, I shall retain. Of the other two kinds of quickly fatal apoplexy, that in which *blood* is found extravasated is far more common than that in which there is effusion of *serum* only. The one has been called *sanguineous apoplexy*; a better term is *cerebral hæmorrhage*: the other has been named *serous apoplexy*.

I will not say, for I do not think, that there is no such thing as serous apoplexy—which is the opinion of many writers; but I do believe that almost all the cases which were formerly classed under that head, were really cases of uræmic coma. And I may tell you that the renal disease just mentioned leads to tissue-changes, which are very apt to result in cerebral hæmorrhage. When apoplectic coma happens in connection with Bright's disease, the occurrence of convulsions in the outset of the attack makes it, in my opinion, probable, though by no means certain, that the coma is due to uræmic poisoning, rather than to the effusion of blood.

Thirdly, the apoplectic coma may terminate in *partial* or *imperfect* recovery. One, or all of the cerebral functions may be left impaired; the mind enfeebled; the power of motion limited, or lost, in some parts of the frame; the faculty of sensation benumbed or extinguished: the unhappy subject of the attack remaining more or less crippled in body, and more or less maimed in intellect. In these cases, when at length we have an opportunity of examining the brain, we almost always find traces of damage inflicted upon its texture at the period of the attack. A part of this damage has usually consisted in the extravasation of blood to a small or moderate amount: sometimes, with or without extravasated blood, there is softening or disruption of the nervous substance. I shall return to these points presently.

The *attack* of apoplexy does not always occur in the same manner: and Dr. Abercrombie has pointed out three several ways in which it is apt to come on. I am confident, from the result of my own observation, that the distinctions laid down by Dr. Abercrombie are just and true: and it is of importance that you should be aware of them. 'In the first form of the attack, the patient falls down suddenly, deprived of sense and motion, and lies like a person in a deep sleep; his face generally flushed, his breathing stertorous, his pulse full and not frequent, sometimes below the natural standard. In some of these cases, convulsions occur; in others rigidity and contraction of the muscles of the limbs, sometimes on one side only.'

Now respecting persons seen in this condition, the immediate prognosis is *uncertain*. Some die in a short time, and much blood is found extravasated within the cranium. In a few of those that die early, no effusion either of blood or of serum can be detected. Some, again, die after a rather longer interval. Some recover altogether, without any ill effect of the attack remaining. Others recover from the coma, but are left paralytic of one side, and with some imperfection of speech perhaps, or of one or more of the senses. And this paralysis and imperfection may disappear in a few days, or gradually depart, or remain for life.

In the second form of attack, the coma is not the earliest symptom. The disease generally begins with sudden and sharp pain in the head. The patient becomes pale, faint, and sick, and usually vomits; and sometimes, but not always, falls down in a state of syncope, or resembling syncope, with a bloodless and cold skin, and a feeble pulse. This also is occasionally accompanied by some degree of convulsion. Sometimes he does not fall down, the sudden attack of pain being accompanied only by slight and transient confusion. In either case he commonly recovers in a short time from these symptoms, and is quite sensible, and able to walk; but the headache does not leave him. After a certain interval, which may vary from a few minutes to several hours—and Dr. Abercrombie records cases in which it was even much longer—the patient becomes heavy, forgetful, incoherent, and sinks into coma, from which he never rises again. In some instances, paralysis of one side occurs; but perhaps more often there is no palsy observed.

The disease, when it comes on in this way, with symptoms of what is called *shock*, is much more uniform, and of much worse omen, than when it commences after the former fashion. It is of great use to know this; for to an inexperienced eye the cases do not *seem* so terrible as those in which the patient becomes profoundly comatose from the very first. The apparent amendment is fallacious, and apt to lead one into giving a false prognosis. Very few persons come out of the coma, and a large quantity of blood is usually found extravasated in the brain. These cases are not, as Dr. Abercombie well observes, apoplectic in the outset. They differ remarkably from the first set of cases. If there be at the very beginning some loss of sense or motion, it goes off again in a very few minutes, or perhaps in a few seconds: the prominent symptom, at the commencement, is sudden and violent pain of the head, with faintness, sickness, and often with vomiting. The pain continues, and is sometimes confined to one side of the head; the face is pale and ghastly, the pulse weak, and often frequent or irregular; but the patient is quite conscious, and in full possession of his intellect. At length he recovers his natural temperature, his countenance improves, and the pulse becomes stronger and steadier: then his face gets flushed, he feels oppressed, answers questions slowly, and at last sinks into stupor and fatal coma. The period between the first attack and the commencement of the coma is variable. Sometimes the stupor succeeds the pain and faintness so rapidly, that the case comes greatly to resemble those in which coma is the first symptom, and takes place suddenly; but still a short period of sense, commonly with complaint of great pain, may be observed. But the interval may be a quarter of an hour, or many hours, or even two or three days. 'Upon inspection,' says Dr. Abercrombie, 'we find none of those varieties and ambiguities, which occur in the apoplectic cases, but uniform and extensive extravasation of blood.' [I should state that he calls the first class of cases *apoplectic* cases, the coma being present from the beginning: and the second class, which we are now considering, he calls cases *not primarily apoplectic.*] The symptoms in this form of attack depend, no doubt, upon the giving way of some one of the cerebral vessels. At the moment when the vessel is ruptured, a shock is given to the brain; a temporary derangement of its functions occurs; but this passes off. The circulation then goes on as before, until such a quantity of blood has escaped from the ruptured vessel as is sufficient to produce coma. There is no part of Dr. Abercombie's book more admirable, and clearly put, than that which is occupied with these important distinctions, which I give you very much in his own words. He points out the close analogy which exists between this variety of apoplexy, and the result of external injuries, when they occasion extravasation of blood on the surface of the brain. The hurt person recovers from the immediate effects of the accident, walks home perhaps, and after some time becomes stupid, and at last comatose. The surgeon trephines the skull, and discovers blood upon the dura mater; and the blood being removed, the coma goes off. We cannot help *our* patients by a similar expedient; though the opinion has been broached that trepanning the skull will, at some future period, be a common practice in apoplexy. Dr. Abercrombie conjectures that after the rupture has taken place, the hæmorrhage is sometimes stopped by the formation of a clot at the orifice in the vessel, but at length the blood bursts out again, and kills the patient. He relates two cases in which this probably happened; in one of them an interval of three days, and in the other an interval of a fortnight, elapsed between the first attack, and the supervention of coma. The portions of blood extravasated at the two separate periods may sometimes be distinguished by their appearance—their colour and consistence.

The *third* form of attack described by Dr. Abercrombie cannot properly be called an *apoplectic* attack at all; indeed he himself includes this form in the class of *paralytic* cases. It is characterised by sudden loss of power on one side of the body, and not unfrequently by loss or impairment of speech, without loss of consciousness. The patient is sensible, listens to and comprehends your questions, and answers them as well as he is able, either by words, which in many cases he articulates imperfectly, or by gestures. The further progress of the cases that commence in this way is marked by considerable variety. Sometimes the hemiplegia passes gradually in a short time into apoplexy. Sometimes the patient soon gets well, the palsy leaving him entirely. Or a gradual recovery takes place, which is not complete for some weeks or months. Or the patient rallies up to a certain point, and there the improvement stops; he regains the power of moving his leg, but it drags somewhat after him; or the leg recovers, but the arm remains feeble, or his speech continues to be imperfect. And in another variety of this form the patient neither improves on the one hand, nor becomes apoplectic on the other, but is confined to his bed, paralytic, and perhaps speechless, though in possession of his faculties in other respects, and dies at last worn out and exhausted, some weeks, or months it may be, after the attack. In the outset of these cases there is not always complete hemiplegia, sometimes the arm only is affected, sometimes (but much more rarely) the leg only. Or some other voluntary muscles are the first to lose their power.

Dr. Abercrombie speaks of the conditions discovered after death in cases that have thus commenced, as being *inconstant*; but I believe that in a vast majority of instances they will be found to consist of *softening* of the brain, and its consequences, whereby the communication between the centre of volition and the paralysed muscles has been suddenly cut off. With this softening there may, or there may not, be extravasation of blood.

You will find, I think, that most cases of apoplexy, or of palsy akin to apoplexy, range themselves with more or less exactness in one or the other of the three classes which I have been describing. Let me briefly recapitulate them. In the first, the coma is sudden and deep; the condition of the patient thus struck in an instant senseless and motionless, warranting those epithets which the ancients applied to the victims of this disease, of *attoniti* and *siderati*, as if they were thunder-smitten, or planet-struck. In the second form of the attack, the earliest symptom is acute pain of the head, with sickness and faintness; coma *supervening* usually in no long time. The third form is ushered in by sudden hemiplegia, which may or may not lead to loss of consciousness, or stupor.

These broad lines of distinction, being kept in mind, will both furnish assistance towards the diagnosis and the prognosis of this multiform disorder, and also give to your study of it, as it occurs to you in practice, a higher degree of interest than it would possess if all the forms of attack had been jumbled together in one common description.

Though the coma may be sudden, deep, and soon fatal—constituting what the French call *apoplexie foudroyante*—such cases are not properly, though they are popularly, ranked in the category of 'sudden deaths.' Apoplexy may be *rapidly* fatal, but it is seldom *instantly* fatal. With very few exceptions, as Dr. Wilks has stated, sudden death is the consequence of heart-disease, or of disease of the great blood-vessels; of rupture of the aorta, for example. Dr. Hughlings Jackson has, however, recorded the case of a woman who died of cerebral hæmorrhage within five minutes from the first seizure.

When the *apoplectic* state is *fully* formed, in what manner soever the attack may have commenced, it is marked by most or all of the following circumstances. The patient lies totally unconscious of all that may be going on about him. He replies to no questions, he is unmoved by the cries and lamentations of his family; in fact, he does not hear them. His pulse is infrequent, often full, perhaps intermitting. His breathing is peculiar, being slow, sometimes interrupted or irregular, attended with snoring or stertor during *in*spiration, and a puffing out of the cheeks, like the action of one who smokes a pipe, during *ex*piration. Both these peculiarities are referrible to the same principle, and both denote a profound insensibility to all external impressions. There is no longer any voluntary attempt to breathe, yet the involuntary movements of respiration subsist; the medulla oblongata still responds to the impressions which reach it from the lungs and from the skin, still prompts contraction of the muscles that enlarge the capacity of the thorax; but the loose curtain of the palate, and the lips and cheeks, are passive. By the vibrations of the one the stertor is occasioned; the mouth is closed by the mere elasticity of the others, and the flaccid cheeks flap outwards with the explosion of the air, as it escapes when the chest again collapses. The countenance is frequently turgid, and livid; the blood which tinges it is already but half arterialised; the pupils are commonly neither much contracted nor much dilated, but they remain fixed under rapid variations of the light thrown upon them; sometimes they are of unequal size. The limbs lie motionless: either they are all absolutely palsied; or (what probably is often the case) the capacity of motion remaining, the *will* to move them is wanting. If you raise one of them it falls passively down again, when you leave hold of it, like a *dead* limb. Sometimes, however, they are rigid and stiff. Sometimes one is stiff, and the others are limber. And sometimes one or more of them, or those of one side, tremble, or are distinctly convulsed. You find perhaps that the patient is unable to swallow. If you put fluids into his mouth, they appear to choke him, or they run out again at the corners of his lips. His bowels are usually torpid; but if they act, the evacuations are passed in the bed without his knowledge or concern. His urine also flows involuntarily; or is retained in the distended bladder until it fairly *over*flows, and dribbles away perpetually.

When the attack terminates in death, that event is preceded, I believe in almost every case, by profuse perspiration, which bursts forth from every part of the surface, and is often cold and clammy. The pupils are sometimes at this period dilated, one perhaps more so than the other. The pulse becomes more frequent, the breathing more rare, and at last it ceases altogether.

In this description you will perceive that something more is included than pure coma. The absence of consciousness—implying the suspension of thought, of sensation, and of volition—marks plainly the affection of the cerebrum. The symptoms which diversify the apoplectic state, and distinguish one case of the disease from another, proceed from an associated or consecutive affection of the spinal cord. There may, indeed, be merely coma; profound and invincible sopor only. In this condition a morsel of food, or a spoonful of drink, passed far back into the pharynx, is instantly carried onwards by a reflex act of deglutition: the excrements are duly retained, and duly voided: the limbs are simply passive and motionless; neither stiff, nor convulsed. But in the severe cases, inability to swallow, laxity of the sphincters, spasms, rigidity, tremors of the voluntary muscles—more or fewer of these adjuncts to the coma—are very apt to present themselves: and they denote, I say, the direct or indirect extension of the morbid influence on which the apoplexy depends, to the cranio-spinal axis.

An easy and interesting criterion of the degree in which the reflex apparatus may be concerned has been pointed out by Dr. Hall. The orbicularis is the sphincter muscle of the eyelid. Touch the eye-lashes, and the lids involuntarily close: even during sleep the movements of the shut lids are apparent. If, in apoplexy, they do not respond to this mechanical stimulus, we know that the true spinal functions are gravely implicated.

On the other hand, many of the morbid phenomena just mentioned may occur, without any affection, from first to last, of the intelligence. But to these forms of disease, although their nature and essence may be the same, the term apoplexy cannot properly be applied.

This state, so appalling and painful to look upon, but fortunately so devoid of suffering for the patient—this suspension of the functions of animal life—depends, we have reason to believe, upon *pressure* applied to the brain, the organ subservient to those functions.

That excess of pressure is a *vera causa* is obvious, and that it is adequate to the production of coma is capable of demonstrative proof. It is not enough to show that they often exist together, for the coincidence might be casual. Neither does their occasional disjunction, real or apparent, furnish any conclusive argument against the general proposition, that coma, in many and in most cases, is the result of pressure upon the encephalon.

Coma may exist without pressure. In other words, coma acknowledges *other* causes also *besides* pressure. It is produced by many narcotic poisons; by the circulation of venous blood through the arteries. In these cases we have no proof of any compression of the cerebral substance.

The other disjunctive condition is much more puzzling, and has led some persons to question or deny the general proposition. Can there be unnatural pressure, yet no coma? It would seem so. Serum, pus, blood, have been met with in the brain, foreign matters have penetrated the cranium, and coma has not ensued.

The force of this difficulty is lessened by the consideration that foreign substances may be present within the skull, without occasioning any preternatural degree of pressure. We read of bullets being carried about for some time in the brain. In such instances it is probable that a portion of the contents of the skull was forced out at the time of injury: or that coma has come on, and gone off again, in consequence of the gradual absorption of the cerebral matter to make room for the foreign body. The same explanation may be applied to the chronic accumulation of water within the cranium, and to the slow growth of tumours.

There is some reason to believe that it is not on every part of the brain that the same degree of pressure made will produce the effect ascribed to it. It is stated in 'Mayo's Physiology' as the result of actual experiments on animals, that *lateral* pressure against the hemispheres of the brain produces no observable ill consequence; but that vertical pressure, pressure downwards, occasions stupor; which is probably attributable to compression of the central or deep-seated ganglia. Now it is obvious that some injuries of the brain may tend more than others to cause pressure in that direction.

The difficulty may not be wholly relieved by these considerations. But it is a difficulty which cannot invalidate the evidence of numerous facts that attest the agency of pressure, as, at least, one cause of coma. The presumption of such agency arises whenever coma immediately succeeds to pressure; and it is converted into certainty if, upon the removal of the pressure, the coma immediately departs. Now the annals of physic are full of instances of that kind. In experiments upon animals, stupor has been brought on, and made to cease, at the pleasure of the operator, by applying pressure to the exposed brain, and by remitting that pressure. Nay, the experiment has been tried on the human brain itself. A man who had undergone the operation of trepanning, and had recovered, was in the habit of exhibiting himself for money in Paris, where Haller saw him. He suffered the spectators to make pressure upon his brain, where it was covered by the soft integuments only. This always put him into a state of coma or deep sleep; but sensibility and the power of voluntary motion returned at once when the pressure was taken off.

A most remarkable example of the occurrence of coma from pressure upon the brain, and of the removal of the coma by removing the pressure, was afforded by a patient who was in St. Thomas's Hospital under the care of Mr. Cline. Mr. Green, who was Cline's nephew, was in the habit of relating the case in his lectures here. It is quite pertinent to my present purpose. One of Cline's apprentices was visiting the depôt at Deptford, and discovered there a man who had been for some time in a state of unconsciousness: and he had him removed to St. Thomas's. His main symptoms were apparent insensibility to all surrounding objects, and a total incapacity of communicating with those about him; except that his attendants learned to infer, from certain instinctive movements or gestures, that he felt hunger, or thirst, or a want to relieve his bowels. His fingers were permanently bent towards the palm of the hand, and his eyes were turned upwards, so that the corneæ were completely concealed beneath the upper lids.

Upon examining this man's head, Mr. Cline found that there had been fracture with depression of one of the parietal bones. He trepanned that part, and elevated the bone. The patient seemed to feel the operation; and as soon as it was concluded, his eyes and fingers were restored to their natural position. On the evening of the same day he sat up in bed, and though at first stupid and incoherent, soon became rational and well.

When he had entirely recovered his senses, it was ascertained that the last thing he remembered was his serving on board a vessel which made a capture off Minorca. He was wounded in the engagement, and carried afterwards to the hospital at Gibraltar. All this happened upwards of twelve months before the operation. So that one whole year of this patient's life was a complete blank, because, during that period, a little piece of bone was pressing upon his brain.

Cases of this kind show, very convincingly, the connection that subsists between pressure on the brain and coma, and their relation to each other as cause and effect. The pressure and the coma begin together; the coma continues as long as the pressure continues; and it ceases when the pressure is removed. The old definition of the *cause* of a morbid condition is completely satisfied: 'Præsens morbum facit, mutata mutat, sublata tollit.'

Observe, in passing, that in the case just described there was not only coma, but a permanent contraction also of certain muscles; that these muscles did not through that long period of time become unfit for the exercise of their proper function; and that the pressure was applied to the *periphery* of the brain.

As the cerebral functions may be suspended by various other causes, more or less obvious, it seems natural to ask whether there may not be some one ultimate condition, the common result of each of these several causes, which is essential to, or at any rate always effectual for, the production of coma, of unconsciousness. And if so, what that ultimate condition is?

To these questions, Dr. George Johnson seems to me to have given very satisfactory answers, in a lecture of his which I have read in the 'Medical Times and Gazette.'

You may call to mind what I said in a former lecture of the constant flux and mutation of all the tissues of the body, however stable they may outwardly appear to be: a ceaseless change upon which, in fact, their persistent living integrity depends. The essence of this change of tissue is its *oxidation.* Apply this to the brain-tissue. For the maintenance of its proper functions, it requires a continuous supply of oxygen. Now oxygen is brought into the capillaries by the blood which has just derived it from the air in the lungs. If the supply b any how limited or suspended, the cerebral functions languis or stop.

What are the chief acknowledged causes of coma? Pressure; the circulation of venous, *i.e.*, unaerated, *i.e.*, unoxygenated blood; various poisons, the poison of opium, of alcohol, of urea accumulated in the blood; of certain inhaled, and so-called anæsthetic vapours, chloroform, sulphuric æther, carbonic acid, nitrous oxide; long exposure to intense cold.

How do these severally affect the brain-tissue? What is the *modus operandi* in each case?

Take, first, the simplest, perhaps, of these causes, the inhalation of nitrous oxide gas. This is believed to act by mere exclusion of oxygen from the lungs and from the blood. It is inhaled and exhaled again unchanged. It speedily produces unconsciousness, which as speedily passes away when atmospheric air is again admitted into the lungs. It furnishes the simplest case of the circulation of unoxygenated blood through the arteries and, therefore, through the capillaries of the brain. It is the privation of oxygen, and not the presence or increase of carbonic acid, which is thus suspensive of consciousness.

Many poisonous vapours and substances, no doubt, enter the blood, and they probably operate by hindering or preventing the giving up of oxygen from the blood to the tissues. Fermented and spirituous liquors diminish the amount of carbonic acid thrown off by the lungs, and therefore of oxygen taken into the blood. In uræmic poisoning, as I shall hereafter more fully explain to you, the unpurified blood is shut out from the capillaries by spasmodic contraction of the minute arteries of the brain.

What, again, is the immediate effect of *pressure* upon the brain? It may crush and destroy its very texture, and so abolish its functions. But pressure short of this may clearly obstruct the access of oxygen to the brain-tissue. With regard to the supply of arterial blood, and therefore of oxygen, a *squeezed* brain, as Mr. Jonathan Hutchinson has truly observed, is an *anæmic* brain. And thus we see how a state akin to coma may result from emptiness of the capillaries of the brain, the unconsciousness of syncope. Probably the oxygen is carried chiefly in the red corpuscles of the blood. If they are scanty, and the circulation be languid from feebleness of the heart, as is often the case in ill-fed and exhausted infants, drowsiness, and even coma, are, as Dr. Johnson observes, intelligible results. But pressure even short of that which *empties* the cerebral blood-vessels may have the same consequence by *arresting* the blood-stream through the capillaries. The blood thus made stagnant in those tubes has at once given up its oxygen, and further oxidation of the brain-tissue thereupon ceases. The same effect is produced by obstruction, however caused, to the current of the blood in the cerebral veins, impeding its return from the head, and implying retardation, and at length stagnation perhaps, of the blood in the cerebral capillaries.

The drowsiness which is brought on by extreme cold—of which I gave you in a former lecture some striking examples—is probably to be explained, as the late Dr. Snow suggested, by the diminished consumption of oxygen which is thus induced.

The same author held that all narcotics act by impeding oxidation—which, chemically speaking, is *combustion*. You may learn, by a simple experiment, the influence of chloroform vapour in arresting combustion. 'Put a few drops of chloroform into a tumbler; then gradually lower a short lighted taper into the tumbler. As the taper descends into the glass, the flame begins to smoke, and is soon extinguished by the vapour.'

To sum up—nearly in Dr. Johnson's words—while sometimes coma is a result of the arrested circulation of blood, sometimes of defective oxygenation of blood, and sometimes, again, of the addition of some narcotic to the blood; the proximate cause is in every instance identical—namely, a defective oxidation of the nervous tissue.

From this digression—not altogether foreign to our subject—I return to the consideration of the pathology of apoplexy.

If the patient recover from the coma, he may live a few hours, or days, or he may live for many years. Sometimes, as the coma departs, all the natural functions are gradually restored; but much more commonly paralysis remains. You already know that it is apt to affect one side of the body only. If a line be drawn from the vertex to the perinæum, dividing the body into two halves, which, so far as the exterior is concerned, are symmetrical, the muscles that are palsied and powerless are voluntary muscles, and all of them lie on the same side of this line. This state of things is called *hemiplegia*. *Paraplegia*, that condition in which all the muscles below a transverse line are palsied, though it sometimes results from cerebral disease, is much more commonly the consequence of mischief in the spine.

Hemiplegia, I say, may remain after the coma of apoplexy has passed away. But I have already told you that hemiplegia may occur without antecedent coma, as a primary affection. The actual phenomena are the same in either case; and a careful study of these phenomena you will find to abound with interest. Let us first see more precisely what they are.

In the most ordinary form of hemiplegia, when it is complete, there is total palsy of the muscles of the *limbs* on one side of the body. The patient may *will* the motion of his leg, or his arm, but neither of them any longer obeys the act of volition; if they are lifted by a bystander, and then let go, they drop down like logs of wood. With this there is generally also palsy, less pronounced, and commonly less abiding, of some of the muscles of the face on the same side, and of the tongue. The affected cheek hangs looser than the other, and the angle of the mouth on the sound side is drawn outwards by the unbalanced tension of its proper muscles. The blank half of the face is that which answers to the paralysed limbs. The point of the tongue, when put out beyond the lips, turns towards the palsied side. The muscles which protrude it are powerless, or weak, on that side, and in full vigour on the other. That half of the tongue which corresponds with the sound side is pushed further out than the other half, and therefore the tongue bends to the palsied side. Such is the fact, and such is the explanation of it. But there are exceptions to this. Gaps in the row of teeth may regulate the direction of the protruded tongue. Sometimes it comes out straight; sometimes the patient cannot thrust it forth at all; and sometimes, even, it deviates towards the sound side. The *rule* is as I have stated it.

This also has been noticed of the tongue in such cases; that the patient has been able, after some effort, to thrust it suddenly out, and then has required a certain interval of time before he could do so again; as if the spent nervous power were slowly regenerated. With these different affections of the tongue, the patient's speech is variously altered. His voice is apt to be thick, muttering, inarticulate, or unintelligible. Sometimes, even though he may be quite conscious and rational, he is unable to utter a syllable; or his efforts result in the constant use and repetition of some one inappropriate word or phrase; and he seems vexed at finding that his attempts to converse are fruitless. But this is a very interesting point, to which I must hereafter return.

Supposing the patient to recover, wholly or partially, from the paralysis, the face, the tongue, and the *leg*, in nine cases out of ten, ay, and in a much larger proportion than that, recover first and fastest: sooner and quicker I mean than the *arm*. And another fact, quite analogous to this, is that when one of the extremities alone is affected with paralysis, it is, in nineteen cases out of twenty, the *arm* that is so affected. I give you again the *rules*; they are liable to occasional exceptions. It is stated by Romberg that hemiplegic paralysis dependent upon *spinal*, and not upon *cerebral* mischief, is more persistent in the leg than in the arm.

This, then, is one way in which the hemiplegia may become, or be from the first, incomplete: viz. in *extent*. One limb may be powerless and the other strong. But the palsy may also be incomplete in *degree*. The patient may be able to move and use his limbs, but they are feeble. Such movements as he is capable of are commenced slowly; as though the effort of volition were not obeyed, as it is in health, on the instant. He cannot bend his fist firmly; nor lift his arm beyond a certain height. Or his leg feels heavy to him, and trails a little behind as he walks; he is unable to stand upon that limb; or to plant his foot securely, or with the usual precision. In short, there are innumerable gradations of paralysis, from slight weakness of the affected muscles to perfect immobility.

Besides the *palsy*, there is mostly *anæsthesia* also. But this is by no means so constant a symptom as the paralysis. The function of sensation (wherefore I cannot tell) is less frequently abolished or perverted than the function of voluntary motion. When the sensibility is lost, or blunted, or any how modified, it is so, commonly, in the same parts that are affected with paralysis. But sometimes there is anæsthesia, and no palsy; and, more strange still, there has been sometimes anæsthesia of one side and palsy of the other. As a general rule, the anæsthesia is less common, and less strongly marked than the palsy; and is much sooner recovered from.

Tracing these cases onwards—such cases, I mean, as do not perfectly recover,—we find that the palsied limbs are usually colder than their fellows. This probably is owing to the diminished circulation of blood through the capillaries: there is not so much blood converted into venous from arterial; and less animal heat is developed. This has been observed even when the main artery of the part has beat as forcibly as in the corresponding part on the other side.

It is necessary to be aware that these palsied parts do not resist the influence of cold or of heat so well as the sound parts. When the sensibility is blunted, we can readily understand how the limb may become burned, from the absence of any warning pain that an injurious degree of heat is applied: but this is not all. A lower degree of temperature than would injure a sound part has often been found prejudicial to a palsied part: and if these palsied parts get chilled by frost, they more readily vesicate and inflame, on the return of heat, than other parts: water merely *warm* will sometimes act upon them like *scalding* water. I say a knowledge of this fact is of practical moment. That amount of warmth which the palsied limb fails to generate for itself, we must accumulate for it by warm clothing; and we must take care that it is never exposed to any artificial temperature which exceeds a certain point. We sometimes see mischief done by applying hot bottles or bricks—*too* hot—to such limbs.

The mental faculties are, in some few instances, quite unhurt by the attack: too frequently, however, they suffer irreparable damage. Of many persons, a striking alteration is evident in the whole character and temper. The brave man has become timid; the prudent man foolish; the calm and cheerful man peevish and impatient. There is no longer the same power of attention, the same capacity for business, the same clearness and comprehension of thought. And whatever other changes may be observable, there are two ways, especially, in which an apoplectic patient, after he has emerged from the coma, is very apt to be affected: viz., by a defection of memory, more or less partial; and by a peculiar tendency to emotion, particularly the emotion of grief: he will weep for very slight causes, sometimes long after the attack of apoplexy or of paralysis has passed over. This is very curious. I may tell you that the same readiness to shed tears, and to be immoderately affected by trifling causes of emotion, is sometimes noticed among the *precursory* symptoms of apoplexy.

LECTURE XXIV.

Hemiplegia continued. Cerebral Hæmorrhage. Changes of, and around, the extravasated Blood. White Softening of the Brain. How produced. Parts of the Brain most commonly implicated.

We were engaged with the subject of apoplexy. I requested your particular attention to the threefold mode in which that fearful disorder has been observed to make its attack. I described the apoplectic state itself, and endeavoured to elucidate the manner of its production. Lastly, I brought under your notice the ordinary phenomena of hemiplegia, which is sometimes left as a legacy of the apoplectic state, sometimes occurs without the pre-existence of that state.

Take care to guard yourselves against the not uncommon mistake of looking upon hemiplegia as being in itself a disease. It is a mere symptom; yet, as I think, the most interesting of all symptoms. It is an outward visible signal of inward hidden mischief, the place and the nature of which it is our business, when we can, to discover. The parts whose failure we notice, the palsied muscles, are sound enough. Now the place or seat of the internal change which has rendered them immoveable can usually be specified within certain narrow limits. The nature of that change requires a more minute scrutiny.

Hemiplegia proclaims some damage or obstruction of the 'motor tract,' above the decussation of the anterior pyramids of the medulla oblongata. Most physiologists agree in believing that the corpus striatum forms the terminus, so to speak, from which depart all the mandates sent downwards by the will to the voluntary muscles; and that what is called the motor tract, the road by which those mandates travel, or, to use the graphic language of Dr. Hughlings Jackson, 'the way out,' starting from the gray matter of the corpus striatum, or its neighbourhood, lies along the fibres of the inferior layer of the crus cerebri and through the pons Varolii to the anterior pyramids, where it crosses over to the opposite side, along the antero-lateral columns of the spinal cord, and so reaches the anterior roots of the spinal nerves. In the cervical portion of the cord the lateral columns have a larger share than the anterior columns in forming the path of the volition-motor influence.

The course of this motor tract, in its upper part at least, is plainly marked by the wasting which it is found to undergo in persons dead after having been for some time hemiplegic through disease or injury of the corpus striatum.

'The way in,' I may observe in passing—the track of the centripetal sensory impressions—is not so certainly known. The fibres of the posterior roots of the spinal nerves are said, by Dr. Brown-Séquard and others, to enter the gray matter of the cord, and to pass over to its opposite side; the sensory impressions being transmitted brainwards by the gray matter, and traversing at length the olivary columns of the medulla oblongata and their continuations to the sensorium; probably to the optic tubercles and thalamus.

Again, the 'way out' from the *cerebellum* lies along the fibres of the crura, and by those of the restiform bodies, to the spinal cord, and probably along its posterior columns, which are supposed to be commissural between its different segments, associating thus and harmonising their several action.

It is a pathological fact, ascertained and confirmed by multiplied and unwavering experience, that cerebral hemiplegia is the result of disease or injury in the opposite side of the brain: and a conclusive and pleasing explanation of this is furnished by the anatomical fact of the crossing over of nervous fibres at the junction between the oblong and the spinal marrows. Mr. Mayo, in his 'Outlines of Pathology,' has made a happy use of two facts previously ascertained, which, taken together, afford a very neat *proof* that the transference of the morbid influence, or privation of influence, from one side to the other, actually takes place in that very part of the nervous system where the decussating fibres meet. The *facts* are stated by Dr. Yelloly, in the 'Medico-Chirurgical Transactions.' Sir Astley Cooper divided the right half of the spinal cord of a dog, in the space between the occiput and the atlas; immediately, that is, after the cord has emerged from the skull through the foramen magnum: the result of this division of the cord was hemiplegia, paralysis of the limbs, on the *same side* with the injury. The bridge by which the morbid effect crosses over must therefore be *above* that point. We have got a limit on one side. And a case observed by Dr. Yelloly gives us a limit on the other. He examined the head of a man who had died hemiplegic; and he found a tumour, as big as a filbert, imbedded in and pressing upon the *right* side of the *annular protuberance.* The palsy had existed on the *left* side. The bridge of communication must consequently lie *below* that point.

It must lie, therefore, between the two points now indicated; *i.e.*, it must be either in the medulla oblongata, or just at the junction of the medulla oblongata with the medulla spinalis. Now in this very interval, *and here alone*, a decussation of the nervous filaments is found to exist. There can be no doubt that the decussating fibres form the channel of communication.

Within somewhat narrow limits, then, we can assign the seat of the morbid condition upon which hemiplegia depends: and we have next to enquire what the morbid condition, in any given instance, may be.

There may be, in the specified area, blood effused; or softening of the cerebral substance; or both of these conditions; or a tumour or other cause of pressure upon it; or some disease which has spoiled its proper texture. We have to ask ourselves which of these several morbid states exists in our actual patient. Sometimes we can answer the question with tolerable confidence; sometimes we must be content with probability or conjecture. I will consider them in their order.

First, there may be a clot of blood occupying or influencing the motor tract; in other words, the hemiplegia may be due to *cerebral hæmorrhage.* Some writers, of late years especially, have regarded cerebral hæmorrhage and apoplexy as convertible terms. This, in my opinion, is a mistake much to be regretted; for it leads to needless confusion and uncertainty. Apoplexy—I have already defined what I mean by that term, which is what the older writers also meant—may happen without cerebral hæmorrhage; cerebral hæmorrhage may happen without apoplexy; or the two may occur in conjunction, as cause and effect. Of the presence of one of them, in the living patient, we have evidence that is positive and visible; the presence of the other can be only a matter of inference. The misnomer has begotten further perversions of language. Since cerebral hæmorrhage has been reckoned synonymous with apoplexy, we find the term apoplexy applied—by a sort of reflex error, and in defiance of its true and etymological meaning—to hæmorrhage into various other organs of the body; and thus we hear and read of pulmonary apoplexy, renal apoplexy, apoplexy of the retina, and what not. In my judgment this strange looseness of language ought to be banished from medical literature. ‘Pray you avoid it.’

The amount, as well as the situation of the blood, extravasated in *cerebral hæmorrhage,* varies greatly. Sometimes it is spread over the surface of the brain, on or between the membranes. Sometimes it is collected in one or more of the ventricles: but much more often it occupies the broken substance of the brain itself; and then, if its quantity be considerable, it generally forces its way either into the ventricles, or (less frequently) to the surface, or even in both these directions at once. In such cases, *apoplectic* symptoms, and death, are the invariable consequences of the hæmorrhage.

Extravasation of blood upon the surface of the brain—between the dura mater and the skull, into the arachnoid cavity, or among the meshes of the pia mater—what is sometimes called *meningeal* hæmorrhage, is the least common form of hæmorrhage within the cranium. It occurs more frequently in children than in adults. Often it is a consequence of external injury, whereby the middle meningeal artery has been torn; or it may proceed from the rupture of a small aneurism. These also are hopeless cases.

It has been thought that blood effused upon the surface of one hemisphere may come to compress the corpus striatum on that side, to squeeze out the blood from its vessels, and so to produce hemiplegia. But this, I conceive, must be of very rare occurrence.

When blood poured into the substance of the brain does not break a passage out, either in the one direction or the other, its pressure is not necessarily or immediately mortal. The patient may survive for weeks, or months, or years; and the clot of blood may, in the meantime, undergo remarkable changes.

Of course the cavity in which it lies varies in magnitude in different cases. It may be barely big enough to receive a large pea: it may be capable of containing a hen's egg. When examined not long after its formation, the clot is soft and of a dark colour; much like black-currant jelly. The sides of the cavity are irregular and ragged; and the cerebral substance of which they are formed is generally, to the depth of a line or two, moist, soft, and as if stained of a reddish or yellowish colour, which is fainter in proportion as it is more distant from the coagulum, and gradually loses itself in the natural tint of the surrounding parts. By degrees this stain disappears. The clot becomes more and more firm; assumes first a brownish, and subsequently a pale red, or even yellowish hue; diminishes continually in bulk; and at length may, I suppose, be entirely re-absorbed. Meanwhile the walls of the cavity become less uneven, and clothe themselves by degrees, as they contract upon the shrinking coagulum, with a distinct membrane of a yellowish colour, sometimes of extreme delicacy, and resembling the serous membranes; sometimes thick and apparently fibrous. It is said that these cysts are capable of being obliterated by a process of cicatrization. This I have never myself seen. But they often remain filled with a gelatinous or serous liquid; or traversed by threads, more or less numerous, of areolar tissue; or containing a small residue of the original clot of blood, with which there may be intermingled distinct crystals of *hœmatoidine.*

It is impossible to assign the precise period within which these remarkable changes may be accomplished. Dr. Abercrombie has detailed an instance in which a coagulum, that must have been of very considerable size, had entirely disappeared in less than five months. In another of his cases it was seen to be partially absorbed at the end of three months. 'On the other hand, Moulin found a small coagulum not quite gone at the end of a year: and Riobé observed some of the blood still remaining in a cavity of small extent after twenty months. In two cases Serres found a hard coagulum of blood remaining; in one at the end of two, and in the other at the end of three years.'

It frequently happens that a patient has suffered, during life, several distinct attacks of apoplexy or of cerebral hæmorrhage; and that as many cells are met with after death, exhibiting respectively various stages of that process of healing which has just been described.

These are the changes that mostly take place in the coagulum, and its containing cell, when the hæmorrhage does not prove fatal, and the patient recovers more or less completely. But the same changes do not always, or necessarily, occur. Instead of being gradually removed by absorption, the extravasated blood appears occasionally to become a solid, organised, and consequently living mass, deriving its nourishment from the arteries of the brain. A man, whose case is related by Andral, was smitten with apoplexy, and remained thenceforward, for many years, hemiplegic. At length he died, of some other complaint, in the wards of La Charité. When his brain was examined there was found, in one of the hemispheres, a mass of a pale red colour and fibrous appearance, traversed by numerous small blood-vessels which anastomosed with those of the brain: the surrounding nervous matter retained its natural aspect; and there was no appearance of any cyst.

I have yet to mention another, and a fatal consequence of hæmorrhage into the substance of the brain. It is not, I think, a very frequent consequence; yet it deserves attention the more, because the risk of its occurrence may perhaps be lessened by judicious treatment in the outset. The clot sometimes provokes suppurative inflammation of the cerebral matter around it: or it may be that the nervous pulp, being bruised or torn by the first violent irruption of the blood, suppurates spontaneously afterwards. It is affirmed (by what French author I forget) that the patient cannot be considered secure against this consecutive mischief until eight days of safety have elapsed from the period of the apoplectic seizure.

Instances of this result of cerebral hæmorrhage, according to my experience, are not, I say, very common. I have before me some memoranda of the last case of it that I saw.

I received, on the 3rd of September, a note, written in a remarkably clear and neat hand, desiring that I would call upon the writer, as he had had a severe attack of apoplexy a day or two before.

I concluded that the note had been penned by some member of the patient's family, and I expected to see him in his bed, paralytic probably, or manifestly ill. But I found a stout active gentleman, walking about in his drawing-room, apparently in perfect health, and declaring that he felt so. He showed me, however, a paper written by a surgeon who on the previous day had brought him to town from a distance, and who had been obliged to return immediately. The paper stated that Mr. —— had suffered a sudden and decided fit of apoplexy on August 30; that he was then freely bled; that perfect consciousness was not restored, nor the force of the pulse subdued, till twenty ounces of blood had issued from his arm; and that on the evening of the same day sixteen ounces more were drawn.

My patient spoke of going down to his country-house, where he had, he said, 'a good deal of shooting to do.' I dissuaded him from this, and enjoined perfect quiet for at least a fortnight to come.

The next day, after a long and imprudent conversation with a friend, he suddenly lost the thread of his discourse, and could not recover it. Then he became confused and misapplied words. I asked him how he felt. He answered, 'Not quite right,' and this he repeated very many times, abbreviating it first into 'not right,' and at length into 'n'ight.' Wishing to mention 'camphor,' he called it 'pamphlet.' I give these as specimens.

On the fifth it was evident that his *right* arm and leg were weak in comparison with the others; but their sensibility was unimpaired. By slow degrees the weakness degenerated into complete palsy, and the right side of his face became blank. Gradually also he grew heavy, stupid, comatose, unable to speak, with a fixed pupil; and so, on the morning of September 15, he died.

His head was examined the next day. On the left side, the dura mater adhered to the skull-cap with morbid firmness. During the endeavours made to detach it, a table-spoonful, or more, of dirty-looking, greenish, very offensive pus spurted forth. This was found to have proceeded from an abscess, which must have contained two ounces of pus, and which was situated in the upper part of the left hemisphere of the cerebrum. The walls of the abscess looked as if they were coated with a layer of yellowish plaster. In the centre of this cavity was a small, fibrous, tough mass of a dull red colour; the coagulum, doubtless, of blood effused on August 30. In front of the abscess the brain *seemed* natural, but its consistence was that of liquid custard.

Mark and remember the situation of this damage, and the associated symptoms relative to the patient's speech.

If we push our enquiries beyond the visible clot of blood which is the immediate cause of the hemiplegia, we find that, anterior to the damage of the nervous pulp, there has been in most cases a process of disease going on in the cerebral arteries; that fatty degeneration, to wit, of which I spoke in a former lecture, and which begins, most probably, in the muscular element of those vessels. The change is not limited, in general, to the smaller vessels of the brain, but is distributed, under the shape of atheromatous patches, throughout various of the larger arteries of the body; in the aorta, in the iliacs, in the radial artery, where, in the living patient, it may sometimes be *felt*, in the carotid, vertebral, and basilar arteries, and in their ramifications. At length the dilapidated artery gives way under the pressure of the circulating blood, which pours through its broken walls.

Just in the same way occurs the second form which I have mentioned of damage to the motor tract, that of *white softening*; only, in this case, from some slight variation of circumstances, the nutrient blood does not break through its vessels, but the healthy supply of it is diminished; parts of the brain are starved, grow soft, and at length are utterly disorganised. A portion of the road along which the motor influence should travel is broken up. *Paralysis* occurs: paralysis without loss of consciousness, for there is no necessary pressure.

The process of decay which I have just described is a gradual process, yet the palsy, like the apoplexy from hæmorrhage, may be sudden. Degeneration of the cerebral substance precedes the final disruption of the motor fibres: and there are often symptoms of such gradual spoiling of the blood-vessels, and of the brain—premonitory symptoms of the palsy. Of these I shall say more as I go on.

But there is another way in which white softening of the brain, and its consequences, may be more rapidly produced. One or more of the larger cerebral blood-vessels may be plugged, or compressed, and the supply of blood to the corresponding portion of the brain suddenly shut off; and then that portion soon loses its consistency, and its organic structure, and liquefies into a mere pulp. Dr. Todd has recorded, in the 'Medico-Chirurgical Transactions,' a case of this kind which I saw in consultation with him at Norwood. The common carotid on the right side was closed, and its channel rendered impervious, by blood which had dissected its way between the layers of the middle coat of the aorta after passing through a transverse rent in that vessel. Paralysis of the left side of the body followed three days afterwards, with white softening of a large portion of the cerebral substance on the same side with the shut carotid. Similar mischief in the brain sometimes results from ligature of that artery for the cure of aneurism. But a different, and by no means an unfrequent, source of obstruction to the cerebral (or other) arteries, consequent upon disease existing in a distant organ, was first discovered and explained by the late Dr. Kirkes. I shall hereafter describe to you certain fibrinous excrescences or deposits to which the valves of the heart are liable. These are sometimes so soft that portions of them are broken off, and washed away by the circulating blood: and thus may be carried in any direction till they enter some blood-vessel which they cannot pass through, and which they so seal up. When this happens in one of certain arteries of the brain, the necessary results are white softening and paralysis. The anatomical distribution of the arteries at the base of the brain explains why it is that a solid mass coming through the internal carotid is more frequently arrested in the middle cerebral artery than elsewhere; and why the obstruction of that vessel at its origin shuts off nearly all their nutrient blood from those portions of the brain which are supplied by its branches. For reasons to be given hereafter, this accident is more likely to take place in the *early* periods of life: white softening from dilapidation of the blood-vessels in the *later*.

Hæmorrhage into the brain may occur with little or no previous alteration of the cerebral substance, which the blood then ploughs up and crushes; but it seldom does so occur except under external violence, or from the sudden spontaneous rupture of a *large* blood-vessel. I just now told you that the larger blood-vessels as well as the smaller are very subject to disease, and especially to that fatty and calcareous degeneration of their inner coats which is sometimes called atheroma, or, popularly, ossification. The disease shows itself in whitish patches of a round or oblong shape, which render the bore of the affected artery unequal in capacity, and its inner surface uneven. This variation of calibre impedes the free passage of the blood, and tends indirectly to increase its pressure upon the sides of the vessel. At the same time the coats of the artery lose their natural elasticity, become weak and frangible, and at length incapable of sustaining the impulse of the blood, and sudden hæmorrhage ensues. The arteries at the base of the brain are liable to *aneurism* also, and to consequent rupture. Morgagni has reported cases of aneurism affecting the internal carotid and basilar arteries. Serres has described a case of apoplexy resulting from perforation of the basilar artery, which was dilated, not far from its superior bifurcation, into an aneurismal pouch as big as a hen's egg. Dr. Baillie records an instance where both the internal carotids, on the side of the sella turcica, were distended into little aneurisms, one of the aneurisms being about the size of a cherry, the other somewhat smaller: and similar examples are related by other writers. I have seen two such myself: a beautiful preparation of one of them is preserved in the museum of the College of Physicians.

Again, white softening may take place without cerebral hæmorrhage: but neither is this very common, except from the sudden plugging or obstruction of a considerable blood-vessel. You will easily perceive how it is that the two conditions, the effusion of blood and the softening, are so commonly found co-existing. The softening, which is caused by the degeneration of the blood-vessels, combines with that degeneration in facilitating their rupture. The support which the healthy nervous substance afforded them is lessened and ultimately lost, till at length those fibres of the brain which hitherto had sufficed to convey, though perhaps imperfectly, its peculiar influences, either give way of themselves, or are broken down by a small gush of blood from the fracture of minute blood-vessels. The character of the attack—the presence or absence of pressure upon the central parts of the brain, and of coma the result of such pressure—depends much, as I have said before, upon the amount of blood poured out, and upon the place where it is shed.

No doubt softening of the brain may be produced by inflammation of its tissue: but the concomitant symptoms will generally enable you to discriminate between such cases, and those of atrophic softening which ensues from the defective supply of nutritive blood to portions of the brain.

It has long been known that hæmorrhage does not occur in all parts of the *substance* of the brain indifferently. Morgagni had remarked the frequency of sanguineous effusions in or near the corpora striata and optic thalami; and more extensive subsequent research has amply verified the general correctness of his observation. The same parts are also more frequently than any others, the seat of atrophic softening. The explanation is that these are the most vascular parts of the brain. Cerebral hæmorrhage takes place, as a rule, in the motor track. It has been noticed that the corpora striata are especially subject to laceration and sanguine effusion, while the surrounding parts remain unhurt, in violent concussions of the brain. And when injections are forced into the cerebral blood-vessels in the dead body, it is in the very same parts, the corpora striata above all others, that a sort of factitious hæmorrhage is produced by the rupture of vessels, and the escape of their contents. In these facts we find a satisfactory explanation of the frequency of hemiplegia in cases of cerebral hæmorrhage, and in cases of cerebral softening.

LECTURE XXV.

Hemiplegia continued—muscles affected. Dr. Broadbent's theory. The palsied muscles rigid, or lax. Other symptoms sometimes combined with hemiplegia. Aphasia. M. Broca's theory. Dr. Moxon's hypothesis. Diagnostic and prognostic symptoms in apoplexy and palsy. Predisposing circumstances. Premonitory signs. Exciting causes. Treatment of apoplexy and palsy. Heat apoplexy, or sun-stroke.

We were engaged in studying hemiplegia as a symptom, in endeavouring to settle the place and the nature of its physical cause within the head, in trying to interpret its ordinary phenomena. The subject is far from being exhausted.

It must, I think, have struck you as very remarkable that—with the exception generally of some slight and often transient affection of certain muscles of the face and of the tongue—the only muscles which are sensibly and decidedly palsied in hemiplegia are the muscles that move the *limbs*. Those which minister to the special senses, and those which subserve the organic functions of the body, are unaffected. The eyes, and also the head, are moveable in all directions; under the action of the intercostals and of the diaphragm the chest rises and falls as fully on the one side as on the other; the abdominal muscles contract on both sides of the median line.

How are these exemptions to be accounted for? Various unsuccessful attempts had been made to solve the problem; but it was reserved for the sagacity of Dr. Broadbent to furnish what appears to be its true solution.

One marked distinction between the muscles that suffer and the muscles that escape paralysis I have already noticed. The muscles palsied are purely voluntary muscles: the muscles which continue to act are muscles that have constant automatic functions, while they are subject also to the occasional controlling influence of the will.

This distinction does not, however, of itself, help us much: for in the case in question these same muscles continue to *obey* the will; they are *not* palsied. A hemiplegic man can voluntarily draw without impediment a long breath, or make a forcible expiration; can rise from the supine into the sitting posture by the contraction of his abdominal muscles; and winks with both his eyes.

The real verdict is given by Dr. Broadbent in this brief sentence: 'The parts paralysed are such as have the power of acting independently of the corresponding parts of the opposite side. The muscles which escape are those which act only bilaterally, or in concert with the corresponding muscles of the opposite side.'

The limbs require, for their free and thorough use, the capacity of perfectly independent movements. The limbs of the two sides, the two limbs of the same side, the different divisions and joinings of the same limb, each and all move, in response to the bidding of the will, readily, severally, separately, in various combinations and in various directions, or all together. The prime centres of volitional movements—that is, according to the received theory, the corpora striata—exercise a direct control over the purely voluntary muscles of the limbs, and they lie widely apart from each other. From the decussation of the pyramids the motor tracts fork upwards. The function of one of this pair of bodies may therefore be impaired or abolished, while that of the other remains in full force. But the control of these centres over the muscles which in hemiplegia escape paralysis seems to be less direct. Within what is called the mesocephale there must lie intermediate secondary portions of gray matter, or centres, which govern their movements. Not only are these muscles pairs, but it is requisite that their natural action should be bilateral and simultaneous; and it is so. The corresponding muscles on the two sides act naturally together; the pair contract in concert. So strict is this rule that no effort of the will can break it: it may check, or it may strengthen, their joint action, but it is unable to ordain their separate action. In health nobody can move one of his eyes without moving at the same time, and in exact correspondence, the other; contract or expand one side only of his chest; compress by mere muscular effort this or that half of his belly. It is a very reasonable theory—nay, it is more than a theory—that the intermediate centres which rule these pairs of muscles lie, if double, closely together; are associated by commissural fibres; or are directly blended into one: and this sort of union may be complete or incomplete. They are subservient to the volitional impulses from both the corpora striata; and they yield a joint obedience to the impulse from one corpus striatum alone. Either corpus striatum will suffice to operate, through these intermediate wedded centres, upon the muscles which belong to them on both sides of the body, and thus to produce the bilateral concert. While one motor tract above the intermediate centre may be spoiled, the requisite influence may descend through the other, which supplies its defect.

The communion, I say, may be complete, or incomplete. Close observation has shown that some of the automatic muscles of the paralysed side, those of the abdomen for example, obey the will somewhat more slowly and imperfectly in these cases: and perhaps these muscles are capable, in health, of some small amount of independent voluntary movement. Some persons are unable to wink with one eye only; and Dr. Broadbent mentions a fact, which was first pointed out, I believe, by the late Dr. Bazire, and which I had failed to notice for myself, that a hemiplegic patient cannot shut the eye of the paralysed side alone, the other remaining open. I shall quote to you his summing up. 'According to this hypothesis, then, if the centre of volitional action of one side is destroyed, or one channel of motor power is cut across, the other will transmit an impulse to the common centre, and this will be communicated to the nerves of the two sides; equally, if the fusion of the two nuclei is complete, and there will be no paralysis—more or less imperfectly to the nerve of the affected side if the transverse communication between it and its fellow is not so perfect; in which case there will be a corresponding degree of paralysis.'

Dr. Broadbent's doctrine is clenched by the fact, which, however, he has not made use of, that in *spinal* hemiplegia, where the interfering cause of the palsy is applied beyond or below the intermediate centres, the corresponding muscle of the several pairs *is* paralysed. This has been ascertained by experiments made upon animals: but we have full proof of it in the operation of disease. A most interesting case has been left on record by Dr. Todd of spinal hemiplegia on the left side, the result of pressure. The odontoid process of the second vertebra was morbidly enlarged by a fibro-cartilaginous growth, which had compressed and flattened the spinal cord on the left of the median fissure. In other respects the body was healthy. Ultimately there was complete paralysis, not only of the left limbs, but also of the intercostal and abdominal muscles of the left side, which remained perfectly motionless during respiration. 'A remarkable sign indicated the want of equilibrium between the right and left abdominal muscles; the umbilicus at each expiration was distinctly drawn to the right side.' Conversely, the phenomena of *hemispasm*—of convulsions limited to the limbs of one side—further confirm and are explained by Dr. Broadbent's theory. The muscles of the thorax and abdomen on both sides, and both the masseter muscles, are implicated in the spasms. The morbid motor impulse passes through the wedded centre to the nerves and muscles on both sides. Practically, then, as Dr. Hughlings Jackson puts it, muscles which act bilaterally are equally connected with each of the corpora striata.

The only real difficulty belonging to this doctrine is met with, Dr. Broadbent observes, in the neck. The head is rotated from side to side, or inclined backwards and forwards, as readily by a patient with hemiplegia as by a sound man. The forward and backward movements may be accounted for by the bilateral action of the muscles engaged, the recti antici, and the muscles of the back of the neck. The rotatory movements do not admit of so easy an explanation. 'But it is to be noted that although in rotation no two corresponding muscles are engaged, yet there are associated in it muscles belonging to opposite sides of the body, and their centres may not improbably be associated. In lateral movements of the neck and of the back both sides act, one limiting, the other effecting, the motion.'

Dr. Broadbent essays also, but with arguments scarcely so satisfying, to explain why it is that sensation is but slightly affected, and sometimes is not affected at all, when the motor power is lost. He first adduces the relative position of the corpus striatum and the optic thalamus. The former ganglion lies in front of and external to the latter, and may therefore, he says, be extensively damaged, without any injury either to the thalamus itself, or to the fibres that connect it with the cord. On the other hand, the thalamus, placed behind the corpus striatum and upon those fibres connecting it with the cord, could scarcely be much affected without injury to those fibres, or to the corpus striatum itself.

In the second place, from the assumed physiological relations between these bodies, severe injury limited to the thalamus might be likely to act by inhibiting the function of the sound corpus striatum.

To explain why, in cases where apparently the same amount of injury has been done by hæmorrhage, or by softening, to both these ganglionic bodies, the loss of sensation is not so great in degree as the loss of motor power, he makes use of the fact ascertained by Dr. Brown-Séquard, Vulpian, and others, that a very slender *continuous* thread of gray matter in the cord will suffice to carry sensory impressions—as rendering the prevalence of the same law not improbable in the higher part of the sensory tract and in the thalamus.

Another, and a somewhat different, question here naturally presents itself. Hemiplegia is often, as I have said, incomplete *in extent*. One only of the limbs on the affected side may be palsied. Almost always it is the arm. Can any explanation be suggested of this unequal distribution of the palsy?

Some physiologists have supposed that the corpus striatum governs the muscles of the arm, the optic thalamus those of the leg. But this notion is inconsistent with the hypothesis which we have adopted respecting the relation of these two glandular bodies to each other.

Again, it has been thought that, the arm alone being powerless, the paralysing influence has not been strong enough to reach the more distant muscles. And this seems plausible where the palsy is owing to hæmorrhage or to some other mechanical violence done to the brain; but it will not apply to those cases in which the nervous power is simply shut off, by softening and disruption of the fibres of the motor tract.

The longitudinal white tubular filaments are, many or fewer of them, continuous throughout the whole of their course along the spinal cord and within the cranium. Of these some go to the nerves connected with the upper extremities, some to those of the lower. It is at least conceivable that in the damage done to the motor tract some of these strands may be involved, and others spared. And this diversity of mischief would account not only for the case in question, but also for anomalies that are sometimes noticed, such, for instance, as the occurrence of paralysis of the *leg only*, from brain disease. I find that Dr. Hughlings Jackson has a similar suggestion—namely, that there may be a part of the higher portion of the motor tract which contains fibres from the legs, and none from the arms.

Hitherto I have been discussing hemiplegia as it is seen in its simplest, which is also its most ordinary form; but there are, in many cases, divers additional phenomena, which materially affect its signification, and almost always worsen the prognosis.

I have described the palsied muscles as being lax and inert; the limbs as loose and supple, bending backwards or forwards readily when moved by the hand of another, or by the sound hand of the patient himself. But sometimes they are, on the contrary, more or less stiff and contracted. They resist the attempted movement. You cannot extend or bend them much; and your endeavour to do so gives the patient pain. The rigidity may affect both the flexor and the extensor muscles, but it is principally seen in the flexor. It may present itself in both limbs, but it is most often manifest in the arm, especially in its biceps muscle.

These facts had long been recognised. The light which they shed on the pathology of brain disease, and the guidance which they may sometimes furnish towards its treatment, are comparatively modern contributions to practical medicine. We owe this valuable addition to our knowledge on these subjects to your late distinguished teacher, Dr. Todd. His doctrines are fully expounded in his volume of 'Clinical Lectures on Paralysis, Disease of the Brain, and other Affections of the Nervous System;' from which I gather very much of what I am now about to tell you.

Rigidity of the limbs in hemiplegia may occur simultaneously with, or presently after, the palsy; and then it indicates 'irritative disease' within the cranium. It may come on slowly, late in the course of the disorder, after perfect resolution and flaccidity of the muscles in the first instance; and then it shows that there has been 'loss of substance of the brain, and that a cicatrix is undergoing contraction.'

The rigidity that happens early in the disease may be slight and partial, one or two only of the palsied muscles being stiff while the others are flaccid; or it may be considerable, and affect nearly all the muscles. If you try to extend the patient's arm, or to straighten his fingers, you find that the biceps in the one case, and the flexores digitorum in the other, are, or at once become, stiff, and resist your efforts: and in like manner, though less strikingly, the triceps of the arm may forbid its flexion. The same may be said, *mutatis mutandis*, of the corresponding muscles of the leg, when that limb also is affected. Sometimes, but not often, the muscles concerned in mastication are implicated. The patient, though insensible, resists powerfully any attempt to pull open his mouth.

This early rigidity is occasionally preceded or accompanied by convulsive movements. It is attended with little or no wasting of the affected muscles.

The rigidity that remains late in the disease, may follow either of the two earlier conditions—the lax or the stiff condition—of the palsied muscles. Like the former rigid state, it is sometimes slightly marked; while sometimes it is extreme in extent and in degree, the hand being carried up to the shoulder, the fingers bent into the palm, which is hurt by the growth of the nails, and even the heel fixed firmly against the buttock. Whatever its degree, this form of rigidity is *permanent*; and the tense rigid muscles, and the limbs to which they belong, gradually dwindle. Inaction of the muscles, according to the principle which I explained to you in a very early part of these lectures, leads to lessened nutrition, and a consequent diminution of bulk; in one word, to atrophy. Sometimes, however, the size of the helpless limb is maintained, or even augmented, by the supervention of œdema. The motion of the blood in its veins not being aided by the play of its muscles, its areolar tissue becomes infiltered with serous liquid.

When in the outset of hemiplegia the palsied limbs are lax and flabby, there is both early and rapid wasting of their muscles.

Dr. Todd's theory, I repeat, with respect to the early rigidity, occurring with or without convulsive movements, is that it is connected with *irritation* within the cranium: with laceration of a sound piece of brain, for instance, by a clot of extravasated blood—with an inflammatory condition of its hurt, or around its softened, substance—with the mechanical irritation produced by depressed bone in fracture of the skull. And the occurrence of this early rigidity warrants the opinion that the cerebral mischief or irritation lies on, or not far beneath, the *surface* of the brain: especially if it be accompanied with pain of the head. Dr. Hughlings Jackson's experience has led him to a similar conclusion. 'Continued rigidity,' he says, 'soon after a seizure, points frequently to hæmorrhage over one hemisphere.' The late rigidity was believed by Dr. Todd to accompany a gradual shrinking and contraction of the cerebral matter, during the process of healing set up in the torn or otherwise injured brain.

There may indeed be no actual *cicatrix*. Dr. Wilks mentions the case of a man who had had his arm rigidly fixed across his chest, and his fingers contracted, for nearly two years, and whose brain presented on one side little more than a hollow space.

It may be affirmed, generally, of hemiplegia as a symptom, that it is more or less formidable in proportion as it includes indications that more or fewer of the cranial nerves are involved in the disease producing it. This is a point to which Dr.

Hughlings Jackson has paid much attention. For your profit I must borrow largely from his published experience.

Damage to the brain of any kind, from clot, from abscess, from tumour, from hydatid, when limited to one of the cerebral hemispheres above the level of the lateral ventricle, need not, unless very extensive, be fatal, and may not declare its presence by any definite or plain-speaking symptoms.

I have many times told you that in ordinary hemiplegia the *seventh* and the *ninth* cranial nerves alone take part—and that but slightly—and the paralysis which their implication causes is on the same side with that of the limbs. This shows that some of the fibres of the seventh or facial nerve are connected with the higher portions of the motor tract, and cross over at the pyramids in company with those which go to the limbs. According to Dr. Brown-Séquard, few fibres of that nerve reach higher than the pons Varolii. When the functions of the facial nerve on either side are entirely suspended, the muscles supplied by it on that side of the face are all palsied; and palsied very completely and decidedly. Such paralysis, in cases of hemiplegia, is extremely uncommon, yet it does occasionally happen: in other words, it is extremely uncommon in combination with other symptoms that denote brain disease; abundantly common, however, I shall hereafter show you, as an independent form of local paralysis, from damage to the trunk of the nerve. It follows from this that the slightest degree of paralysis of the facial muscles is more alarming, and of much worse omen, than their complete paralysis; as pointing to deeper-seated and more central mischief. It is often the forerunner of disease more extensive and ruinous.

Similar remarks may be made in respect of the partial paralysis of the tongue in hemiplegia. The roots of the *hypoglossal* nerve seem to arise near the place of decussation of the anterior pyramids, so that some of its fibres come off without crossing, like the spinal nerves; while others, like the higher cephalic, are transferred to the opposite side.

The eyes, and the head, are, in some instances, turned fixedly for a while *from* the palsied side. This occasional symptom is also commonly a transitory one. Like those other early symptoms that soon pass away, it also must, I think, be regarded as an effect of the primary *shock* of the attack—of what M. Trousseau calls *cerebral surprise.*

Whenever, in hemiplegia, you meet with drooping of the upper eyelid on the opposite side, a diverging squint, inability to move the eye except outwards, a dilated pupil—all or some of these symptoms—you will know that the functions of the *third* nerve are interfered with on that side, and that the brain-mischief involves the lower part of the crus cerebri on the side opposite to the palsied limbs. All or some I say; there may be no ptosis, the lower branch only of the third nerve being affected. Dr. Wilks mentions an instance of this. The pupil was, however, dilated.

Central hæmorrhage, or other material damage, in the *pons Varolii*, has this of especial interest, that it produces the very same symptoms as are produced by a poisonous dose of opium, namely deep coma, paralysis of the limbs of both sides, and contracted pupils: the one condition leading to certain and speedy death—the other, under proper methods of treatment, capable of perfect recovery.

If the injury be limited to one side of the pons, there will probably be interference with the functions of the *fifth*, or of the *sixth*, or of the *seventh* nerve, or of all of these—manifested on the side opposite to the hemiplegia: for their central nuclei lie closely together. Conversely if such interference be indicated, the site of the internal mischief may be approximately inferred.

Thanks to the patient, minute, and skilful researches of modern physiologists, and especially in this country of Dr. Lockhart Clarke, we now know that various cranial nerves take their origin within a very limited space, and close to each other. Accordingly if we find that the muscles concerned in swallowing, in articulation, those that govern the voice, those that give expression to the features, are affected, we conclude that the mischief is deeply seated, involving more or fewer of the neighbouring nuclei of the hypoglossal, glosso-pharyngeal, spinal accessory, vagus, facial, and trigeminal nerves: and that the case is therefore one of extreme peril.

In some such way we try to analyse and decypher the various combinations of symptoms that may present themselves in alliance with hemiplegia. I can do little more, towards helping you, than point out the method of proceeding. I may add that, in all the cases to which I have just been referring, hæmorrhage is much more likely than softening, to be the cause of the palsy.

There yet remains of hemiplegia one prominent complication, which from its very nature, and from the direction of modern enquiry and speculation concerning it, has become invested with peculiar and seductive interest: I mean that loss or impairment of the *cerebral* power of *speech*, which is now commonly called *Aphasia*. It would be impossible for me, and if possible it would be out of place, to discuss at any length the many and subtle questions which have sprung up on this abstruse and difficult subject; questions inevitably obscure and perplexing since they relate to conditions in which the attributes of mind and of matter are inseparably mixed up together, and mutually inter-dependent. But I cannot altogether ignore these questions. I must endeavour to set some of them at least before you, in connection with the facts, actual and alleged, which have suggested them.

Observe that by the term aphasia is signified—not the mere impairment of articulation, such as in the outset of ordinary hemiplegia is not uncommon from paralysis of the muscles employed in speaking, the speech becoming indistinct, but not unintelligible; nor the loss of voice (*Aphonia*) which may occur from disease or defect in the larynx; not any modification of *lingual* or of *laryngeal* speech at all; but, impediment or failure in the faculty of *language*: the faculty which, in its largest sense, includes the power, given to man alone, of expressing his thoughts and feelings by words and sentences spoken or written, by the play of his features, by smiles or frowns or tears, as well as by what may be called the intuitive inarticulate speech of the lower animals, which consists of changing tones of the voice, and pantomimic attitudes and gestures. It is the intellectual and not the mechanical element of speech that we are here chiefly concerned with.

After the comprehensive definition which I have given of the faculty of language, you will not be surprised to learn that with the loss or impairment of the power of *speech*, there is combined more or less loss or impairment of the power of *writing* also, and of *pantomimic* expression. I include all these three defects under the single term Aphasia; though there are rare instances of loss of speech only, *Aphemia*, and of loss of the power of writing only, *Agraphia*.

Of the two factors of this compound symptom, I take first the hemiplegia, which often happens without aphasia. So also aphasia not seldom happens without hemiplegia. When they occur together the hemiplegia, in an immense majority of cases, is on the *right* side of the body: so often as to constitute a rule to which there are very few clear exceptions. Whether those few exceptions of aphasia combined with hemiplegia of the *left* limbs, really refute, or prove, certain hypotheses deduced from that rule, time and further research may perhaps determine. The facts carry with them the corresponding rule, that the brain-damage is always, or nearly always, on the left side.

Furthermore, it has been affirmed that the essential brain-damage occupies a certain region, the anterior lobe of the left cerebral hemisphere; or, with still greater particularity (according to M. Broca of Paris), the posterior part of the third or inferior frontal convolution of that lobe. I need not consume your time and my own by going into a long history of these opinions. You may learn it from various books. It is briefly and clearly told in the 'Edinburgh Medical Journal' for 1866, by Dr. Sanders. It has been very fully given by Dr. Bateman of Norwich. You may read it, as related by Dr. William Ogle, in the second volume of the 'St. George's Hospital Reports,' and in an able paper contributed to the 'Lancet' in 1868, by Dr. Maudsley. I must refer you also, most especially, to Dr. Hughlings Jackson's thoughtful and philosophical disquisitions upon this curious subject.

To the alleged fact last mentioned, the local allotment of the brain-mischief, the exceptions are more numerous and decided. Mr. Broca himself acknowledges that he has witnessed the examination of a brain in which no change could be discovered of the part indicated by him, though aphasia and right hemiplegia had been present before death. The anterior lobes of both sides of the brain have been broken up into a pulp by disease, or crushed by injury, yet the faculty of language has remained untouched. Nay, there is evidence, it has been said, both clinical and physical, that 'there may be perfect loss of the general faculty of language, with total inability to make known thoughts by words or by writing, or even by intelligible signs, and no tangible change of structure in any part of the brain be found after death.' Yet there must be some local damage, or morbid condition, though undiscovered and perhaps undiscoverable.

Upon the various and multiform manifestations of the *aphasic* factor, a large volume might be written. I must confine myself to samples. The patient may be altogether wordless. He may utter inarticulate sounds, or mere unmeaning gabble. He may use, to express all that he tries to express, one or two familiar words only—'yes,' or 'no,' or both of them, are the most common; and these, of all replying words, have most of the character of *automatic* replies; or some word that has no intelligible meaning. On the other hand, he may have abundance of words at his command, but not the right words. He may substitute, in Malaprop fashion, for the right words others which somewhat resemble them in sound (as pamphlet for camphor, dispersion for dispensary), or which have some obvious association with or relation to them (as breakfast for supper, toast for hot). He may forget, or always omit, particular words, or parts of words; or, on the other hand, senselessly interpolate certain words; or he may make a blundering inversion of the syllables of a word (as gippin for pigeon); or invert a whole word (as mug for gum); or shuffle the letters of a word or words confusedly (as tufle for flute—lamb and crobster for crab and lobster). I am giving you actual specimens. And it is worthy of notice that amid all this misuse, fracture, dislocation, and loss of words, the grammatical framework, whereby they should naturally be marshalled into meaning sentences, is seldom deranged. Dr. Ogle remarks that substantives only are substituted for substantives, verbs for verbs, numerals for numerals, proper names for proper names. 'I have never seen,' he says, 'nor read any case in which there was an exception to this rule.' The fact, however, seems to be that the words which are changed, left out, or wrongly used, are, for the most part, nouns.

Again, an aphasic person may repeat, like an echo, everything that is said to him, and say nothing else. Where this peculiarity has occurred the patient has sometimes mimicked also every sign or gesture addressed to him. This, I fancy, is an extremely rare phase of the malady. Generally the intelligence is much less affected than the power of speech; occasionally, indeed, it does not appear to be affected at all. Yet in most cases some kind or degree of *other* mental defect is apparent; defect of ready apprehension, of the power of attention, of sustained thought, or of memory. Dr. Ogle seems even to assign the whole phenomenon to defect of memory, of which he specifies two kinds—inability to remember certain words, immediately remedied if they are prompted by another person—an infirmity notoriously common in advancing age, and called by him *amnemonic* aphasia; and inability to remember *how to say them*, an inability which no prompting can help. This he names *atactic* aphasia, or aphasia proper. But it must be observed that whatever share a partial loss or some modification of the mental power of memory may have in producing aphasia—that faculty is generally perfect enough for other purposes than those of speech. The aphasic patient recognises his acquaintances; remembers where he lives, and knows exactly the topography of his neighbourhood; can often play, not unskilfully, at cards and dominoes, is master of the tricks of the game, and is ready to cheat if he finds himself in danger of losing it. All which implies the possession and the exercise of memory.

To proceed, the patient, however well educated, may or may not be able to read, to spell, or even to point out letters that are named to him. In his efforts to put together the letters which form his own name even, he often can achieve no more than a dim yet perceptible resemblance to it. Thus, one of Dr. Ogle's patients, James Simmonds, composed the letters JICMNOS; another, James Pascoe, produced JASPENOS. With his sound left hand—or if (as may happen) the paralysis departs and the aphasia remains, with his right hand—he may, or he may not, be able to write. He may be able to copy manuscript, or even to convert printed sentences into ordinary writing, when he could not write the same words to verbal dictation. This would show that he had lost the language; of which he simply imitated the characters as he might trace those of some foreign tongue, never known by him. To denote these inabilities in writing Dr. Ogle has coined the name *agraphia.* The aphasic person may automatically reply 'yes,' or 'no,' to a question, and yet immediately afterwards be unable to repeat 'yes' or 'no,' when bidden to do so: and analogous to this is the fact that, though unable otherwise to write, he may readily sign his name, the most automatic of all writing processes. What is most curious is, that under strong emotion or excitement he may utter exclamations and interjections, such as 'bless my soul!' 'oh dear!' or blurt out a familiar oath; though under ordinary circumstances, the emotion being over, he would find it quite impossible to do this. Here, you see, disease draws a marked analytic line of division between the emotions and the intellect; between signs of feelings and signs of ideas. With vulgar people 'oaths,' Dr. Hughlings Jackson remarks, 'belong to the same category as loudness of tone and violence of gesticulation; and swearing is a habit grown up from the impulse to add the force of passing emotions to the expression of ideas.' In the cases before us the oaths are involuntary. The man cannot repeat them. 'Just as a paralysed foot will jump up when the sole is tickled, so these words start out when the mind is excited.'

Here indeed the stimulus is mechanical. But emotion can produce the same singular effect upon limbs and muscles over which volition has no dominion whatever. An artist with whom I was acquainted, and whose arm was almost completely powerless after a recent attack of paralysis, so that no effort of his will sufficed to move it from his side, was one day startled, as he was hobbling across a road, by the unexpected and rapid approach of a carriage. He noticed, with wonder, that during his awkward attempts to get out of the way, the palsied arm was suddenly jerked up above his head. But he could not again lift it there after the fright was over.

On looking back on brief notes, kept through many years, I find frequent evidences of the conjunction of some form of aphasia with right hemiplegia. To some of these recorded instances I have casually referred already. I will describe two or three that have more recently come within my own observation and practice.

A great surgeon, recently lost to us, presented in his last and fatal illness, when he was more than eighty-three years old, a striking example of this singular complication. He was powerless in his right arm, and paralytic in a less degree in his right leg. He could not speak a word; yet his manner and aspect were intelligent. He showed by his looks and gestures that he comprehended all that was said to him; nodded or shook his head in assent or dissent; smiled at any jocular remark; listened to, and evidently enjoyed, works of fiction when they were read to him. He endeavoured also by looks and by movements of his left hand, and by inarticulate sounds, to respond to what was said, and to ask for what he wanted. He tried to write with his left hand, but his markings were, mostly, quite illegible. A curious incident showed that he could not spell. One day he was manifestly anxious to express some want; but neither his family nor I could guess what it might be. I then laid before him a bone alphabet of separate letters, hoping that by its aid he might spell out his wish. He took the hint at once, and placed in order the letters BDCK. This was unintelligible. Benedick? I incredulously asked. He shook his head with a half-amused, half-angry look, and snatching up a penful of ink in his left hand, again essayed to write, but there fell upon the paper a blot of the ink. To this he exultantly pointed; and we came to understand that he desired to have some 'black drop,' the letters he had used showing an abortive attempt to spell the word *black*. This interpretation of his need was acknowledged and confirmed by assenting gestures on his part. He had on several occasions previously signified his desire for an opiate. This is probably a unique instance of a sort of material pun being made under such circumstances. The actual condition of the brain in this case remains unknown.

On the 25th and 27th of May, 1868, the daughter, aged nineteen, of a medical friend of mine complained of pain, for which no cause could be discovered, in her right thigh. Two evenings afterwards, as she was led out by her partner to dance, she suddenly became hemiplegic on the right side. She did not lose her consciousness, nor fall, but was supported to a sofa, and soon taken home. Her face on the right side was blank, but she could close both her eyes. Her power of speech was gone. Her palsied limbs were perfectly supple, and their sensibility was apparently heightened. A loud rough systolic bruit was audible over the aortic valves, and along the track of that vessel towards the right collar bone. She had never had rheumatic fever; and was reckoned a capital walker, having ascended several mountains in Switzerland in the preceding summer.

At first no great impairment of her mental functions was observed. She was in good spirits, comprehended what was said to her, and expressed her assent or dissent by the usual movements of the head. It was soon discovered, however, that she could not read; nor spell; that she did not even know the letters of the alphabet. She could not find B, or an O, in the word AUTOBIOGRAPHY printed large.

Five years previously she had been stunned by a fall; and was kept in a dark room, and said little or nothing, for three or four days; but after that she had appeared to be perfectly well, and was strong and active.

In a fortnight she had regained in great measure the use of her limbs; could raise her hand, and grasp with it, though feebly; could walk, dragging more or less her right leg; and her features were more evenly balanced. She could say 'oh no,' 'papa,' and 'Bob.'

She then went into Yorkshire, where she improved in strength, rode on horseback, and enjoyed her exercise much. On her return to London in November, it was found that she could copy a letter, though she could not compose one. She directed her letters correctly as to the names, but she put down the beginning only of the place; as C(henies) T(ring) to her sister, and Trin(ity) O(xford) to her brother. I gave her four letters of the alphabet to arrange. She put together three, PAY; and then, with a little suggestion, all the four, PRAY.

In the March following she could answer 'yes' or 'no' promptly and rightly; but she had great difficulty in simply saying 'no,' when asked to do so. She picked out certain letters, but when told to find an O, pointed to an R. In May her vocabulary was scarcely enlarged. She could reply 'no,' 'very,' 'oh yes,' but could not repeat 'very.' She could hum a tune, sing 'songs without words,' but was unwilling to try to play on the piano. She worked at a sewing machine, but found it a hard matter to thread the needle. Her hands soon got cold; especially her right hand.

November 1869.—She is not mistress of more words; but her general health is good, and her manner sprightly and intelligent. The cardiac bruit is less harsh. She denies by signs that she is short-breathed. The left side of her face is the most expressive side; and she drags her right leg a little when she is tired or exhausted. She writes her name in a good clear hand; still cannot indite, though she can copy, a letter. Reads to herself. Plays on the piano, but only when alone; apparently from misgiving as to the secure performance of her right fingers. It is certain that she can read music, for she has turned the pages accurately for Mr. Cipriani Potter while he played a difficult piece of Beethoven's.

The youth of this patient, the presence of a cardiac murmur, and the suddenness of the attack, which are common characters of this affection, leave no doubt that it was the consequence of embolism, most probably of the middle cerebral artery. With many of these cases of aphasia, valvular disease of the heart has been concomitant. I would have you notice also the cheerfulness and alacrity of manner displayed by this young lady, as being in accordance with what has frequently been observed in cases of the same kind, and as contrasted with the sadness and dejection and proneness to tearful emotion of many of the subjects of ordinary hemiplegia. This case exemplifies also a fact frequently noticed—that aphasic persons who cannot talk can often *sing* quite correctly.

A retired surgeon, a former fellow-student of mine at St. Bartholomew's Hospital, had been for some time in broken health, but with no symptom relating to his brain. On a certain Thursday he rang his bell, intending to ask for his great-coat, his brougham being at the door. Upon his servant's entrance he began to give his orders, but found that he was uttering unintelligible gabble. He was quite aware of this. The servant supposed that his master had lost his senses. My friend walked about the room, making fruitless efforts to say what he wanted; and getting impatient, he exclaimed, more than once, under that excitement, 'confound it—rubbish—nonsense!' He soon discovered that he could write no better than he could speak, but made unmeaning scrawls upon the paper. His neighbour, Mr. Gregory Forbes, was sent for, and was with him in a quarter of an hour or thereabouts. He had then swallowed some æther and was beginning to mend. This strange state lasted for several hours, he all the while recovering gradually. The next morning he could speak without much difficulty, but was very forgetful of names. He again tried to write, but in the first line of a short note he put c for t in the word strong, and San for John in Johnson: the third line was quite illegible. On the Saturday he seemed to be as well as usual. The defect in the power of writing outlasted somewhat that of speaking—a thing unusual, I believe, in these cases. His talk now was ready, free, natural, and correct. He assured me that at no moment had there been any hitch in his intelligence, or want of mental clearness; nor had there been any trace or degree of paralysis. He had no *other* head-symptoms. He believes that had his brougham been already at the door, and he had got into it without speaking to anyone, and driven about until the difficulty was gone, he would never have known that it had existed. As to his writing, he noticed, as he was recovering, this—that the first part of a word was written correctly, while its ending was often incomplete or wrong: but he found also that if he kept his attention doggedly fixed upon each word in succession till he had finished it, it came out right, and that when he essayed to write in his customary fluent manner, the ends of the words had a tendency to elongate themselves. He showed me a note that he had just penned; the handwriting was excellent, and the only mistake made—which he instantly saw and corrected—was the use of 'in' instead of 'if.' Whenever, in an early period of the attack, he wrote a wrong word, he recognised the error at once, and set it right.

This case was to me the more interesting, as having occurred in the person of an intelligent and thoroughly instructed member of our profession, who, not being over much alarmed by what happened, watched with keen curiosity, and could calmly appreciate, his own exact condition and feelings.

I believe that transitory attacks of aphasia like this are not very uncommon.

In making the distinction between cerebral and lingual defects of speech, there is one mistake into which you might easily fall, and against which I must therefore caution you. An aphasic person often does not put out his tongue when bidden to do so; he cannot put it out; sometimes he will even try to get it out by the help of his fingers. Now this is not to be attributed to *paralysis* of the tongue, to paralysis in the sense in which the arm is paralysed in hemiplegia, any more than the scrawling writing is to be ascribed to paralysis of the fingers. The patient can move his tongue in other directions. Almost always he can utter some one or more words—and he can swallow well—neither of which he could do if his tongue were quite paralysed. And it may occasionally be noticed that the tongue is put out automatically, when the patient cannot voluntarily protrude it—to catch a straying crumb, for example, when he is eating. Moreover, he cannot *write*. So that we have these clinical rules. If a patient cannot talk, and yet can swallow well, he cannot write. If he cannot talk, and cannot swallow well, he can write. In the one case the brain is damaged, in the other the lingual nerves, or their nuclei, are diseased.

Hysterical women may be unable to speak, without any paralysis. Loss of voice is often feigned by impostors. We should suspect a person who pretended that he could not talk, if we found that he could swallow well and write well. He would be likely also to make the blunder of not uttering some one word, or some word-like syllable, as aphasics almost always do. In ordinary hemiplegia the tongue is somewhat paralysed, on one side at least. But Dr. Hughlings Jackson observes, that if the tongue be totally paralysed, and even wasted, *on one side only*, it makes marvellously little difference in the patient's power of protrusion, or in his articulation.

I cannot accept—I put no faith in—the theory upheld by M. Broca and his followers, that the part of the brain specified by him, namely, the posterior part of the inferior frontal convolution of the left cerebral hemisphere, is the seat or organ of language. Two facts, attested by skilled and careful observers, suffice to refute it. First, the fact that aphasia has been known to exist when no alteration could be discovered by the strictest scrutiny of the part in question. Of this fact M. Broca himself is a confessing witness. MM. Vulpian, Charcot, and others testify to similar experience of their own. Secondly, the fact that total disorganisation of that part has been known to exist without any affection of the faculty of language. Corroborating evidence to the same effect is furnished by the additional fact, that after death from cerebral hæmorrhage attended by aphasia, the hæmorrhage has in many instances been confined to other parts of the brain. Thus Andral has collected fourteen cases in which the power of speech was lost, yet no alteration could be detected in the anterior lobes of the brain. In seven of these fourteen cases the brain-damage was situated in its middle lobes, and in the other seven in its posterior lobes. Nor do I believe that there *is* any special seat or organ of language in the brain. We are accustomed to appropriate the intellect—perception, thought, judgment, memory—to the gray matter of the cerebral convolutions generally, and not to any limited nook or corner of that matter; and all these attributes find a place in our compound idea of language, which we cannot conceive to have a more 'local habitation' than they. All of them may subsist when cerebral speech is lost. Like Dr. Hughlings Jackson, most physiologists hold the seeming paradox that 'the faculty of language resides nowhere in the brain, because it resides everywhere.'

Nevertheless, when we take into consideration the complexity of structure of the intra-cranial mass; the remarkable differences in respect of form, arrangement, and number of the cells composing different parts of the gray matter of the convolutions, as certified by Dr. Lockhart Clarke; the many separate spots of gray matter, and therefore of sources or centres of power, interspersed in various places through the white matter, which we look upon as commissural or conducting only; the diversity of symptoms that diseases or injuries of the brain create;—it is impossible not to believe that in that mass of brain-matter there are certain provinces, districts, or tracts, the integrity of which is essential to the accomplishment of this or that function. Since aphasia may exist without any paralysis of muscles, since palsy may exist without any trace of aphasia, it is clear that the 'way out' for the ideas which, clothed in words, at length find utterance through the mouth, and the 'way out' of the volitional motor influence, are not precisely the same 'way:' while the very frequent combination of the two phenomena of aphasia and hemiplegia shows that these two roads must lie very near each other. This inference seems to me quite legitimate: and since the formation of words in the mind, the conversion of ideas into symbols, must always precede their utterance, it is reasonable to conclude that the region which ministers to such formation lies above the origin of the motor tract. Nay, in that (to our ignorant observation seemingly confused, yet doubtless in reality exquisitely adjusted) intermixture of gray and white matter which intervenes between the cerebral hemispheres and the spinal cord, is it not probable, is it not almost certain, that there lie many centres, each having its appropriate influence over centres and parts below it, while all are subordinate to the supreme centres? And if so, may we not with allowable conjecture place among these centres, in some cases at least, the intercepting damage which is the material cause of the aphasia? There may be disease or injury of the gray matter of the convolutions; or of the fibres of communication that converge from them towards the sensorium; or of that collection or series of centres to which I have just adverted. The centres that govern the muscles directly concerned in phonation and articulation appear to be usually, or often, unaffected.

Dr. Charlton Bastian, whose able writings relative to these intricate questions I ought also to have commended to your attention, holds views differing from, yet not contradictory of, those which I have been suggesting. Since our knowledge of things without us flows in from the several organs of sense through different gates of entrance, and by different routes, and reaches the brain in different directions, he conceives that the impressions so conveyed may attain their destination in the gray matter of the cerebral convolutions, through the intervening nervous mass, in the same direction as they entered it, or in some accustomed and constant direction, in each case: so that there may exist corresponding areas of perception in the gray matter, distinct or interblended, or linked together, and connected with lower ganglionic centres, by intercommunicating fibres. He believes, moreover, that words, when we employ them in silent thought, become nascent in the supposed *auditory* area, as remembered or revived *sounds*; that again, in writing, the revival of words as auditory impressions recalls automatically, through long association and training, the corresponding impressions in the *visual* area of the letters that compose the words, and finally that aphasia is the consequence of some material hindrance to these processes. Dr. Hughlings Jackson, on the other hand, is of opinion that thought is carried on, not in subjective sounds of words, but in subjective *movements* for words.

These seem to me to be the chief inferences that have been drawn, or can safely be drawn, from the facts affirmed and admitted upon this mysterious subject.

In explanation of the fact, first publicly noticed by M. Dax of Montpelier, that in cases of aphasia the brain-mischief is, as a rule, on the left side, an ingenious and plausible hypothesis has been offered by Dr. Moxon.

It has been, and it is, a general and a very natural belief that the two cerebral hemispheres, so alike in shape and structure, so evidently a pair, have a similar agreement in their functions: that as, having two eyes, we can see with one alone, or with the other alone, though more thoroughly perhaps with both at once—two lungs, and breathe with both alike, or with one only should the other be disabled by disease or accident—two kidneys, exercising simultaneously the same function during health, or one of them acting by itself, and for both, when the other is disorganised—so we think with the whole or with the half of the cerebrum, there being the same harmony and community of function between the hemispheres, and the same capacity in each of them to supplement the want of action in its fellow.

But there is this notable difference. The other double organs perform their functions fully and completely from the very hour of birth—while the cerebral functions are rudimentary only in the infant, and are gradually and slowly developed as we approach the maturity of life.

Now, all the movements of the human animal, those excepted which are instinctive, emotional, or automatic, all the purposed movements, are acquired by a process of self-education. The human infant learns gradually and slowly to balance itself, to stand alone, to walk, to run, and more slowly still and last of all to speak. We call this a training of the limbs or of the muscles used; but, in fact, the training or education is that of the nervous system which governs the movement learnt. In adult life it is the same. We gain facility, readiness, and precision of willed movements by the frequent repetition of those movements. It is thus that the power of habit is formed. The repetition, the custom, begets and confirms the habit. The habit is mental, dependent on the brain which decrees the movement. For the most part, during our growth this training goes on, *pari passu*, on the two sides of the body alike. But there is one notorious exception. We all grow up right-handed. The right upper limb becomes stronger, capable of more exact, more delicate, and more numerous operations than the left, so as to have supplied our language with the epithet *dexterous*. This is universal; common, I mean, and natural to all nations and races. Now it is Dr. Moxon's hypothesis that language also is a one-sided function; in other words that the brain is educated for this function on one side only, the left side. The right side may indeed sometimes appropriate it, just as some few persons are left-handed. According to this hypothesis, cerebral speech can be interfered with, as a rule, only by disease of the left hemisphere of the brain.

Many instances of the immense influence of such a training process will readily occur to you. Think of the facility ultimately attained by an accomplished player on a musical instrument. The hands and fingers of an expert violinist are taught by constrained and repeated mental attention, by repeated direction of the will (not to particular muscles, for not one person in a thousand knows anything about the muscles concerned, but) to the general result of the endeavour. And most wonderful are the nicety, the precision, the rapidity of touch thus gained. But it is, in reality, a one-sided skill. For the movements of the right hand and arm, the left brain has (upon this hypothesis) been educated—for the still finer touches of the left fingers, the right brain. The education has been both sinistral and dextral, but the same in kind. Not even Paganini or Joachim could reverse the instrument, and finger the strings with his right, and guide the bow with his left hand, so as even to make the slightest approach to the ease and almost spontaneousness with which, in the customary fashion, he draws forth the entrancing tones of his fiddle; an ease and spontaneity, exactly resembling the fluency of speech of a practised orator. In both cases, according to Dr. Moxon, the habit is a one-sided habit, the habit of an educated portion of brain-matter. In the combined phenomena, there is a further point of analogy to be noticed. These aphasic patients, who cannot themselves speak, understand the speech of others; who cannot move their right limbs, do not lose, or lose but in a slight degree, the sensibility of the palsied parts. In both cases it is the 'way out' and not the 'way in' that is broken or obstructed. The efference is what is chiefly hampered, not the afference.

Dr. Moxon's theory implies some belief in what has been called the *duality* of the brain; the capacity for separate and independent action by the two cerebral hemispheres. It has been said that this theory conflicts with Dr. Broadbent's. I do not perceive the inconsistency. If, as I have ventured to suggest, the centre or nervous apparatus concerned in the *formation* of speech lies higher in the brain than the commencement of the motor tract, and if this centre or apparatus have undergone the imputed education on one (the left) side, and not on the other (the right), the right, on that very supposition, would not have acquired, for speech purposes, the power to act upon and through the common, or wedded centre.

Anatomists tell us that, although the two hemispheres and their convolutions are symmetrical in most of the lower mammalia, and in infants, they are not found to be so in man, and especially in educated man. Dr. Ogle remarks that the secondary convolutions are never arranged in the same way in the two hemispheres. 'If (he says) the left hemisphere be almost invariably chosen by nature for the process of education, there must be some difference or other between the two hemispheres to determine that choice. Can this difference be pointed out? I think it may. Owing to the well-known arrangement of the arteries which rise from the aortic arch, the left hemisphere receives by the carotid a more direct and therefore freer supply of blood than does the right. Probably from this cause, but at any rate from some cause or other, the convolutions of the anterior lobe of the left hemisphere are developed at an earlier period than those of the opposite side. This has been made out by the conscientious researches of Gratiolet, whose authority in such a matter no one will call in question. In this fact we have, I think, a sufficient explanation of the matter. Nature selects for the process of education that anterior lobe which is the more mature, and therefore the more apt, or alone apt at that period, to receive it. In this same fact we find a probable reason for most men being right-handed. The right hand being governed by the left hemisphere will have the same advantage in time over its fellow, as has the left hemisphere over the right one. Its education will begin earlier, and where one hand alone has to be educated, this will be the one chosen.'

I will only remark further that, if the theory be well founded, it opens a door for hope that in persons otherwise sound, and not too old to learn, the healthy (that is, in these cases, the right) side of the brain may take up the task, and be gradually educated into the requisite capacity for speech; just as the left hand, in cases of right hemiplegia may be trained, through the influence of the right brain, to write with freedom, and even with elegance; of which I have seen one remarkable instance.

This theory is adopted by Dr. Wilks. Dr. Hughlings Jackson holds that, while both sides of the brain are educated, the left (in most people) is the leading side, and the right the automatic side: that, supposing Gratiolet's statement to be accurate, the left brain is sooner ready for learning—'is the elder brother, who takes and keeps through life the lead.'

I refrain from pronouncing any judgment of my own upon these various speculations and opinions, of which I desire to be considered as being, however imperfectly, the mere expositor.

In the account which I have been endeavouring to give you of the symptoms of apoplexy, of hemiplegia and its complications, of the different modes in which the attacks may commence, and of the various morbid appearances discovered within the cranium in the fatal cases, I have already embodied almost all that can be stated, with any confidence, respecting the special diagnosis and the prognosis of the complex disease. The one of these follows the other: the exact diagnosis being known, the prognosis is seldom difficult. By the diagnosis, however, I do not mean simply the recognition of the disease as a case of apoplexy, or of hemiplegia. Of that *general* diagnosis, of the means of distinguishing the coma of apoplexy from the coma caused by opium, or alcohol, or uræmia, I told you all that I know in a former lecture. Hemiplegia, when it exists, is incontestably evident to our senses. But I use the term diagnosis now in a stricter sense, and in reference to the distinctions that exist between *one case* and *another*; and I say that, the general condition of the bodily tissues being given, in proportion to the accuracy with which we may be capable of determining the precise condition of the contents of the skull, will be the facility of predicting the issue of the complaint. Let me remind you, then, that when a patient suddenly becomes apoplectic, we can very seldom tell whether there be effusion of blood, or effusion of serum, or no effusion at all, within the cranium: and therefore the prognosis must be precarious and uncertain. If after, or without, the use of suitable remedies, the coma persist for many hours, the prognosis becomes worse. In those cases which begin with pain of head, faintness, and nausea, and which pass on to coma, the prognosis is positively bad; for the diagnosis is easy, and we are tolerably certain that a blood-vessel has given way, and that a large quantity of blood has ploughed up or compressed the substance of the brain. In the paralytic cases also, if coma supervene, the prognosis is gloomy: but frequently coma does not supervene, and then our prognosis, so far as life is concerned, may be declared more favourable.

Among the symptoms that belong to the apoplectic condition itself, there are some which experience has selected as being most especially of evil omen; and it is well worth your while to remark that these discouraging signs relate, almost all of them, to the automatic functions of the cranio-spinal axis. The open, fixed, unwinking eye; the explosive flapping of the cheeks in expiration; the inability to swallow; the slow, sighing, interrupted breathing; the loosening of the sphincter muscles of the bladder and anus: these are fearful, and too often fatal symptoms, and they all belong to the excito-motor portion of the nervous system. Perhaps the profuse sweat that so often attends the process of dissolution may be referred to the same source; the whole tone of the various tissues being lost or relaxed. I would not say that no one of these symptoms is ever recovered from: but I may say that of twenty patients in whom such phenomena occur, nineteen will die.

Now symptoms of this kind may be expected to arise, if there be hæmorrhage in or near the medulla oblongata; or if there be mischief so extensive in the brain as to cause pressure upon the medulla oblongata. We should reason out the likelihood that such symptoms would be of bad augury. But the fact that they are so was ascertained long before the theory which accounts for them was devised. The fact is independent of the theory, and for that reason helps wonderfully to confirm it.

The pathology of the brain is closely interwoven with the pathology of the heart and blood-vessels. In every instance of apoplexy or of hemiplegia, it is necessary to enquire into the condition of the apparatus of the circulation.

When sudden hemiplegia, with or without coma, occurs in advanced life—say after the age of fifty—in all probability evidence will present itself of disease in the heart, in the arteries, or in both. You may sometimes feel that the radial artery is unduly rigid, or of unequal calibre, in your living patient. If such evidence should appear, you may infer that there has been thrombosis of some of the smaller arteries, and softening of the brain, or hæmorrhage the result of these conditions. Should there be early rigidity of some of the palsied muscles, you may infer that some irritative cause is in operation within the skull; and if the rigidity be extensive, and especially if it be attended with convulsive movements, the further inference will be warrantable that the cerebral mischief is not far from the surface. If you suspect, from the age or other circumstances of your patient, that he may be the subject of fatty degeneration of the blood-vessels, that suspicion will be strengthened by your finding, on inspection of his cornea, that it shows the arcus senilis.

Again, in the early periods of life, the sudden occurrence of hemiplegia will suggest the suspicion of valvular disease in the heart, and the probability of embolism; and you will search accordingly for signs of such disease.

In relation to these associated forms of disease, apoplexy and hemiplegia, there are certain aphorisms, so I venture to call them, diagnostic and prognostic, laid down by Dr. Hughlings Jackson, which you will find it useful to remember.

It is most improbable that hemiplegia occurring in a person under thirty years of age, *with sound tissues*, should have been caused by effused blood: improbable at any age if, when the paralysis came on, there was no loss of consciousness or only a few seconds of confusion.

Absolute recovery from the paralysis is no proof that a portion of the motor tract has not been permanently destroyed. Cavities of considerable size have been found in the corpus striatum, or in the optic thalamus, of patients who had got rid of their palsy.

A person who has become hemiplegic without losing his consciousness is not in much danger of early death: but if the palsy does not diminish somewhat by the end of a week, it is likely to be permanent.

I call to mind here, however, the case of a well-known sporting baronet, who became suddenly hemiplegic on the right side, without any loss either of consciousness or of speech, and for whom a whole month elapsed before he could stir a finger or a toe: yet he recovered sufficiently for fair skill in partridge-shooting.

Any great deviation from the ordinary pulse of health, remarkable slowness, or remarkable frequency, or alternations of slowness and frequency, or irregularity, is of bad augury. So also is very slow respiration, three or four breathings only in a minute. So is the fixedness of the pupil of the eye under varying degrees of light, especially if the fixed pupil be large.

So long as the palsied limb continues to be supple throughout, and the fingers do not become red, swoln, and sausage-like, recovery may be hoped for.

The most hopeless condition of all is continued rigidity, and pain on moving the limbs; and these cases are not the less hopeless because the hand may relax a little when the patient is warm, or may open whenever he yawns.

According to M. Trousseau's experience of hemiplegia, the earlier and more complete recovery of the palsied arm than of the palsied leg (which is an unfrequent order of events) is a worse omen, in regard to the future, than the contrary.

You will observe that the prognosis depends very much, *cæteris paribus*, upon the general condition of the body. It is bad if there be evidence of general fatty degeneration of the tissues, of senile decay, for then cerebral mischief is merely an accident or step in the progress of that decay. It is bad, for a similar reason, when there is evidence of renal disease; disclosed by certain aspects of the optic disc, but more surely and easily by the detection of albumen in the urine. And you will be surprised to find how often this fatal complication exists.

These diseased conditions are therefore strong *predisposing causes* of apoplexy and palsy.

So also are diseases of the chest, which influence very materially and injuriously the circulation within the head. Without going into detail respecting complaints with which I am obliged to suppose that you are as yet unacquainted, I may state, by anticipation, that impediments to the free transmission of blood through the heart and lungs constitute the mode in which thoracic disorders predispose to apoplexy. The *plethora capitis* produced by such impediments is frequently visible in the turgid and livid features, and in the distended jugular veins.

The cessation of habitual discharges, of the catamenia, of bleeding piles; the drying up of old sores; the healing of long-established issues and setons; all have an unquestionable tendency, by causing or augmenting plethora, to generate a predisposition to apoplexy.

And large observation of the habits of those who fall victims to this terrible malady, leaves no room for doubting that intemperance often paves the way for its invasion. The continued abuse of ardent spirits, in particular, lays the foundation of many of those morbid conditions of the sanguiferous system, and of the viscera, which constitute the predisposition we are now considering.

It must not be forgotten either that attacks of apoplexy are especially to be apprehended in persons whose ancestors have suffered the same disease. Accumulated experience has clearly ascertained that they who come of an apoplectic stock are themselves more than ordinarily liable to apoplexy.

It is an old belief that persons who possess a particular conformation of body are prone to attacks of apoplexy; the pattern of body being denoted by a large head and red face, shortness and thickness of the neck, and a short, stout, squat build. This opinion is as ancient as the time of Hippocrates. Its correctness has become doubtful in modern pathology. Dr. Wilks repudiates it entirely. No doubt apoplexy is common enough in men and women who are thin, and pale, and tall. Yet, for myself, I should not absolutely reject the doctrine that, *cæteris paribus*, corpulent people are in more danger of apoplexy than spare people. Certainly it befalls both the one kind and the other.

Advanced life is a very strong predisposing cause, and the reason of this must be evident to you after what I have said respecting the dependence of these diseases of the brain upon previous disease of the blood-vessels. Fatty degeneration is a *senile* change. Earthy concretions in the coats of the arteries are so frequent in the later periods of existence, that they are met with, according to Bichat, in seven individuals out of ten who die beyond the age of 60; and Dr. Baillie considered ossification to be much more usual in old persons than a healthy state of the arteries. Apoplexy and cerebral paralysis begin to be *common* diseases after 50: but even in young children they do sometimes occur.

Some of these three kinds of predisposition are beyond our power. We cannot exterminate the hereditary tendency; nor remodel the plan upon which the body is constructed; nor arrest, or put back, the clockwork of human life. But we may guard and caution persons, thus predisposed by nature, or by age, towards apoplexy, against many of its exciting causes.

Before I leave this part of our subject, I have something to say respecting the relation between cerebral hæmorrhage and hypertrophy of the left ventricle of the heart: a relation which has been supposed to be always that of effect and cause. It has been held by pathologists of eminence that the powerful contractions of a ventricle thus morbidly strong may drive forwards the blood with so much force, as to strain and break the cerebral arteries. Dr. Hope, in his elaborate work upon Diseases of the Heart, uses these words:—'Instances of apoplexy supervening upon hypertrophy have been so frequently noticed, that the relation of the two, *as cause and effect*, is one of the best established doctrines of modern pathology.' Similar opinions have been expressed by some of the most distinguished of the French writers on this subject; Andral, Bouillaud, Cruveilhier.

Now, with respect to a large number of the cases in which hypertrophy of the left ventricle and cerebral hæmorrhage are found to coexist, I believe the doctrine thus enunciated to be unsound. Yet there is one form of this combination of morbid conditions in which the doctrine holds true. I wish you to recognise the distinction. I will take first the cases in which I believe that the alleged relation of cause and effect does *not* obtain. Hypertrophy of the left ventricle is most frequently associated with other structural changes in the heart: changes which imply impediment to the circulation: changes which involve or influence its right chambers also. In fact, disease of the right heart is not very often seen, without disease of the left: and one of the commonest forms of alteration to which the left side is liable, is hypertrophy of its ventricle. I have already pointed out to you the connection which sometimes subsists between cerebral hæmorrhage and such disease of the heart as obstructs the ready and regular descent of the blood from the head through the *veins*. Many of the cases of apoplexy occurring in persons who have previously had cardiac hypertrophy are, I really believe, cases of this kind. The brain affection is dependent, in part, upon disease of the heart, but not upon the preternatural strength of its left ventricle. The heart acts injuriously upon the brain backwards through the veins, and not through the arteries.

But there is another reason for the coincidence; and here the arteries are concerned.

No one can doubt that the momentum, with which the blood reaches the cerebral arteries, in perfectly *healthy* persons, under violent bodily exercise or mental excitement, must often exceed the momentum produced by a hypertrophic heart in the cerebral arteries of persons who are tranquil and at rest. But apoplectic seizures are frequent under the latter circumstances, infrequent under the former. We must look, therefore, for something more than the mere hypertrophy to explain the coincidence. And (supposing the absence of any check to the flow of blood from the head through the veins) that something is often to be found in *disease* of the arterial system.

When the arteries of the brain are rendered frangible, by fatty degeneration, or ossific change, in the way I have so frequently described, the *commencement of the aorta* also is found, in a great majority of cases, to be the seat of similar alterations;

and, often, to be sensibly dilated. Now the fatty or calcareous disease must seriously impair the elasticity of the vessel; and in this way the free passage of the blood out of the heart will be impeded. Dilatation of the aorta at that part will produce the same hindrance more certainly and in a greater measure. Still more effectually and obviously will any narrowing of the outlet by valvular or other disease prove an impediment. In consequence of these mechanical obstacles to the free exit of the blood from the left ventricle, the walls of that chamber, urged to more vigorous contraction, become thicker and more powerful. The hypertrophy is the natural compensation for the morbid state of the aorta; without it the heart would much sooner become unable to propel its contents at all: and the hypertrophy does not often, I fancy, become greater than is needful for its purpose. The strength of the left ventricle, therefore, in such cases, is not a true measure of the force with which the blood is driven into the distant arteries. Quite the contrary. It is a measure of the *difficulty* with which the blood is circulated through the *primary branches*, and therefore through the entire system of the arteries. It indicates the *diminished* force with which the blood is likely to reach the cerebral vessels. And in point of fact, in *many* cases of hypertrophy of the left ventricle, you will find the pulse at the wrist to be disproportionately small and feeble. So that, *in these cases*, instead of regarding the cerebral hæmorrhage as the *effect* of the hypertrophy, I look upon the apoplexy and the hypertrophy as *concomitant effects of the same cause*; viz., of disease pervading the arterial tree. The hypertrophy of the left ventricle is a consequence of the diseased condition of the aorta at its mouth; the cerebral hæmorrhage is a consequence of a like diseased condition of the arteries in the brain. When you find each of these lesions, and nothing to retard the venous current, you may safely apply this explanation of the occurrence of apoplexy.

My proposition, therefore, is that whenever hypertrophy of the left ventricle results from valvular or other disease of the heart itself, or from obstructive disease of the larger arteries, it is not to be considered the cause of cerebral hæmorrhage, should that also happen.

Yet there is, I say, a form of hypertrophy which is very likely to prove a direct cause of cerebral hæmorrhage. Of Bright's disease of the kidney, when chronic, hypertrophy of the left ventricle, without valvular or other disease of the heart or great arteries to account for it, is an almost constant accompaniment and consequence. How is this?

I must here briefly explain a remarkable discovery of Dr. George Johnson's, which serves to elucidate various morbid conditions of the body, and which constitutes one of the most important and valuable contributions that have been made in our day to pathological science. You will find it fully set forth in the 51st volume of the 'Medico-Chirurgical Transactions.'

It is an anatomical fact that the minute arteries, which in the course of the circulation immediately precede the capillaries, are furnished with circular muscular fibres, endowing them with a function that is well characterised by Dr. Johnson as a *stop-cock* function. It is a pathological fact, demonstrable and demonstrated by the help of the microscope, that these very small muscles are liable to hypertrophy. And a necessary conclusion from this fact is, that the little muscles, when thus augmented in bulk, must have been for some time habitually subject to excessive action, and so have come to be hypertrophied. This is the pregnant *fact* which we owe to Dr. Johnson's sagacious research. What I have next to deliver is his *theory*; to my mind a reasonable and just theory. Whenever the circulating blood is contaminated by any imbibed or inbred impurity, its free entrance into the capillaries is impeded by the strong contraction of these small muscular fibres; and if the impurity be abiding, the continued resistance made by the minute arteries engenders hypertrophy of their contractile fibres.

In Bright's disease the blood is unpurified, and while the minute arteries in various tissues, the skin, the muscles, the brain, and other parts, oppose its passage, the left ventricle beats with increased force to drive it onwards. The result is hypertrophy of the muscular fibres of the arteries, and of the left ventricle of the heart. Apply this doctrine to the brain. The arterial stop-cocks resist the passage of the unpurified blood into the capillaries. The strong left ventricle strives to force on the blood. The resulting distension of the systemic arteries is indicated by the full and hard radial pulse, and by the evidence of increased arterial pressure afforded by the sphygmograph. There is thus excessive pressure on the whole of the arterial pipes between the stop-cocks and the forcing-pump; and in the struggle between the two contending forces a minute artery in the brain may be broken, and so cerebral hæmorrhage may occur.

Among the *premonitory* symptoms of apoplexy *headache* is of frequent occurrence: but the same symptom is abundantly common in persons who are in no danger of apoplexy; it derives its minatory character from the concurrent circumstances. Headaches awaken our fears when they *begin* to be troublesome in advanced life. They are, then, still more formidable if they are accompanied by vertigo; or, without any other evidence of gastric derangement, by nausea and retching. Sometimes, as I have already told you, severe headache ushers in, and almost forms a part of, the apoplectic attack.

Vertigo itself, even without headache, is a very common precursor or warning of an approaching seizure. It is sometimes slight and transient; sometimes almost habitual. Although vertigo may depend upon other causes than mischief within the head, we cannot regard it without apprehension when it often occurs in old persons. It should teach us to obviate as entirely as we can all the known exciting causes of apoplexy. The principal of these I shall by-and-by describe to you.

Transient deafness, or transient blindness, blindness or deafness for a few seconds or minutes, is another of these warning symptoms. Dr. James Gregory, of Edinburgh, used always to mention in his lectures the case of Dr. Adam Ferguson, the celebrated historian, as affording one of the strongest illustrations he ever met with of the benefit that may be derived from timely care to avoid those circumstances which tend to produce plethora and apoplexy. It is, perhaps, the most striking case of the kind on record. Dr. Ferguson experienced several attacks of temporary blindness some time before he had a stroke of palsy; and he did not take these hints so promptly as he should have done. He observed that while he was delivering a lecture, his class, and the papers before him, would disappear, vanish from his sight, and reappear again in a few seconds. He was a man of full habit; at one time corpulent and very ruddy, and, though by no means intemperate, he lived fully. I say he did not attend to these admonitions: and at length, in the sixtieth year of his age, he suffered a decided shock of paralysis. He recovered, however, and from that period, under the advice of his friend, Dr. Black, became a strict Pythagorean in his diet, eating nothing but vegetables, and drinking only water or milk. He got rid of every paralytic symptom, became even robust and muscular for a man of his time of life, and died in full possession of his mental faculties at the advanced age of ninety-three; upwards of thirty years after his first attack. Sir Walter Scott describes him as having been, 'long after his eightieth year, one of the most striking old men it was possible to look at. His firm step and ruddy cheek contrasted agreeably and unexpectedly with his silver locks; and the dress which he usually wore, much resembling that of the Flemish peasant, gave an air of peculiarity to his whole figure. In his conversation, the mixture of original thinking with high moral feeling and extensive learning, his love of country, contempt of luxury, and especially the strong subjection of his passions and feelings to the dominion of his reason, made him, perhaps, the most striking example of the Stoic philosopher which could be seen in modern days.'

This anecdote, which I have made use of as a wrapper for some medical instruction, will not be the less acceptable to you when I add that the remarkable man to whom it relates was the great-uncle of my late friend and former colleague in this school, Dr. Robert Ferguson.

Very frequently slight and partial paralysis is the forerunner of an attack of apoplexy. Double vision is one form in which such limited palsy is apt to show itself. It is evidently connected with some degree of squinting; *i. e.*, some one or more of the muscles that move the eyeball are paralysed; the person cannot direct each eye to the same object at the same time. This is a very suspicious symptom. Dr. Gregory was acquainted with a sportsman who one day, when out shooting, disputed with his gamekeeper as to the number of dogs they had in the field. He asked how he came to bring so many as eight dogs with him. The servant assured him there were but four; and then the gentleman became at once aware of his condition, mounted his horse, and rode home. He had not been long in the house when he was attacked with apoplexy, and died.

Sometimes the slight and local paralysis shows itself in a faltering or inarticulate mode of speaking. The rapidity of the movements of the tongue requisite for distinct utterance is so great, that the slightest weakness of any one of its muscles is rendered obvious. We see this in one very common form of what may in truth be considered a kind of apoplexy; viz., in drunkenness. In many persons the very first symptom of their becoming intoxicated is their inability to speak plainly. 'Clipping the King's English' is the slang expression for it; and the same thing often takes place in respect of the more proper forms of apoplexy.

It is a curious circumstance, by the way, and one which is illustrative of what we meet with in disease, that in different persons different sets of muscles are chiefly affected by inebriation; the same set being always the first affected in the same person. Thus some men, when drunk, lose (as I have just stated) their natural command over the muscles of the tongue, and falter in speech, while they can walk very well: others reel and stagger, having lost, in a greater or less degree, the power of moving and governing their limbs, and of balancing themselves, who yet can speak quite fluently and plainly: and in a few cases, drunken persons become delirious, who still retain the power of distinct articulation, and of directing their steps aright. This being so, we need the less wonder at the variety in the nature of the warnings that precede the apoplectic attack.

In many instances there is numbness or debility, or total palsy of one limb, or of a single finger, or even of a solitary muscle, as of the levator palpebræ. The patient cannot grasp your hand with firmness, or sign his name in his usual way, or pick up a pin, or snuff a candle, or manage an obstinate button, or tie a knot in a thread cleverly: or, perhaps, one of his eyelids droops, and the eye is half closed. Sometimes, on the contrary, the patient stares at you frightfully, with one eye, which he cannot shut.

The numbness also assumes various characters, according to its place and degree. One patient will tell you that he feels as if one of his limbs were muffled in flannel; another, that he is uncertain whether, in walking, his foot has reached the ground or not. A gentleman, since dead of apoplexy, assured me that, when sitting, he did not know how far his breech covered the seat of the chair. With the numbness there is often associated a degree of tingling: that familiar sensation of ‘pins and needles,’ in a part which is recovering after being ‘asleep,’ from pressure upon the trunk of its ministering nerve.

All these symptoms are modifications of the function of voluntary motion; or of the function of sensation. Nor are manifestations wanting, among these precursory circumstances, of a derangement of the other and nobler function, of which the brain forms the material instrument. I mean the function of *thought*.

Thus one very deplorable warning is the loss of *memory*. All persons find, as they grow older, that they do not retain so tenaciously in their recollection things which have recently occurred, as things which happened when they were young. This partly depends upon the degree of *attention* which we pay to different circumstances. Those events which strongly excite the curiosity, and rivet the attention of the boy, become familiar to the man, and he gives them but little notice, and is very apt to forget them. But the loss of memory that threatens apoplexy is something more than this. It is sometimes partial, and extends to certain sets of things only. For example, some persons entirely forget certain words, while they recollect others perfectly. Common words are often thus forgotten, while unusual or remarkable words are remembered; or a wrong word is chosen. As in cases of marked aphasia, one word is used for another that sounds something like it. Thus one of my patients, meaning to accuse a certain individual of *perjury*, always called it *purging*: and many other words he changed after the same fashion. But in truth the modifications of a partial loss of memory that have been known to precede apoplexy are both odd and endless: some people forget their own names, or the names of their children. Dr. Gregory, who had paid particular attention to these precursory symptoms, and who had a large practice for a great number of years to furnish them, used to mention a case of this kind. After some efforts his patient could recall to his recollection what his christian name was, but he could not think of his surname. About twelve months after his memory began to fail in this strange manner he was found dead in his bed. Another gentleman for some time before his death could never recollect the name of the street in which he lived. Upon one occasion of his visiting Edinburgh, he called on Dr. Gregory, and partook of a hearty breakfast, having forgotten that he had breakfasted before he set out. On the same day he attended, with Dr. Gregory, the funeral of a young lady who had been his ward; the funeral took place in the country; and when they returned together in a carriage it was evident that he had forgotten all that he had been doing. Next day he met the doctor in the street, and saluted him with all the kindness of an old acquaintance at first meeting; saying he was happy to have fallen in with him now that he was in town, being totally forgetful of their recent interviews.

Connected with this failure of memory, there is often an unnatural degree of drowsiness. Sometimes without any permanent affection of the memory, there is a temporary confusion or suspension of thought; the patient suddenly loses the train of ideas with which his mind has been occupied; stops short in the middle of a sentence, and endeavours in vain to recover the broken thread of his discourse.

Among the mental conditions that bespeak a tendency to apoplectic disease, I have several times noticed a strange and vague *dread*, of which the person can give no reasonable explanation; a sense of apprehension and insecurity not accounted for by the apparent state of his general powers and functions; a painful degree of indecision and irritability; with a dislike and fear of being left alone. One patient of mine described his 'nervousness' of this kind, by telling me that in descending a staircase, especially a winding one, he was obliged to turn round, and come down backwards, as one descends a ladder; or even to sit down, and so slip, stair by stair, from the top to the bottom. Yet with the assurance given him by a friend's arm, or by a convenient baluster, he could walk down stairs without difficulty. He had no actual vertigo.

All these, and many other signs that are apt to precede and herald an attack of apoplexy or palsy, are well worth your study. They show that, even before the stroke descends, there is some morbid process going on within the head, or pervading perhaps the whole frame. Some of them, no doubt, are the commencing symptoms of the actual disease. The great use of being acquainted with these warning circumstances, and of looking out for them, consists in the opportunity and the *authority* which they furnish, for enforcing upon the person in whom they manifest themselves, the absolute necessity of avoiding all the avoidable *exciting* causes of the disease. But our means of advising him will be very imperfect if we have not carefully considered what these exciting causes are. I propose to devote a few minutes, therefore, to the consideration of the circumstances that are apt to *bring on* the attack. There are many cases of apoplexy and of cerebral hemiplegia, in which we cannot trace the operation of *any* such causes: but in many other cases their influence is decidedly marked; and the avoidance of them, while it is important to all who show a disposition to such diseases, is especially so to those who having once suffered an attack, have reason to dread a *repetition* of it.

In the first place, anything which is calculated to hurry the circulation, and to increase the force of the heart's pulsation, is likely to operate as an exciting cause of apoplexy, or of cerebral palsy: simply by augmenting the momentum of the blood against the sides of the cerebral vessels, which in advanced life are so often diseased and weak. Strong bodily exercise, therefore, is a thing to be shunned by all persons in whom the predisposition to these disorders has declared itself. It is of much importance to make patients aware of this; for many persons think, when they labour under uncomfortable bodily feelings of any kind, that they may get rid of them by a brisk walk, or by galloping some miles over the country on horseback.

Another dangerous state for such persons arises whenever the free escape of the blood from the head is suddenly obstructed. I have adverted to this before. Certain diseases, chiefly thoracic, which tend to keep the veins of the head inordinately full, rank, I repeat, among the *predisposing* causes of apoplexy. But, upon the very same principle, various conditions, which are temporary only, may operate as *exciting* causes. By what is called 'holding the breath,' whether upon an inspiration or an expiration, the transit of the blood through the lungs is impeded: and the check is felt (through the pulmonary artery, right chambers of the heart, and great veins) in the vessels of the head. And this effect is increased when *straining* is at the same time performed; that is, when a deep breath is taken and retained, while some muscular forcing effort is made.

Under this principle fall a number of bodily acts, which, however harmless in a healthy frame, are not without peril to a person having a predisposition to apoplexy. The motion of the blood in the lungs, and therefore in the head, is checked in the acts of coughing, vomiting, sneezing, laughing, crying, shouting, and so forth. You cannot have looked at a person in a violent paroxysm of coughing without seeing that it produced a determination of blood to the head, or rather a congested state of the veins of the head. The jarring pain in the head which is apt to follow each succussion of the cough depends upon this principle: which is often strikingly illustrated in young children labouring under hooping-cough. They turn purple in the face, and become giddy; and not uncommonly ecchymosis of the conjunctiva occurs, giving fearful intimation of what might just as readily take place *within* the cranium. It is not very unusual for the whole of the white part of the eye to become suddenly bloodshotten in these violent fits of coughing; and convulsions even have happened under the like circumstances.

Straining at stool is a common exciting cause of apoplexy in those who are predisposed to it. And this is one of the worst dangers attending costiveness of the bowels in old people: but it is one which it is often in our power effectually to obviate. It is more within our control than a bad cough could be. Any kind of straining indeed is equally perilous. A very good proof of this danger was recently afforded by a patient of my own. He was attacked with apoplexy on his way to Ascot races; and upon recovering somewhat, was found to be paralytic on one side of his body. He was brought back to town, where I saw him. After some time he regained the power of using the affected limbs to a very considerable extent; so as to be able to walk about, and follow his business, which was that of a job-master, or proprietor of a livery stable. I cautioned him seriously, *inter alia*, against straining: but I suppose he forgot my caution. For, while dressing one morning, he tugged violently in attempts to pull on a damp boot, and in the midst of his efforts fell back insensible: and from this relapse he never fairly recovered.

To the same principle are to be referred a variety of things from which a patient, in danger of this disease, must most carefully abstain. Lifting heavy weights; leaping; striking a hard blow; playing on wind instruments; even long and loud talking. Dr. Abercrombie relates two instances of fatal apoplexy brought on (as it would seem) by a sustained exertion of the voice: one of the attacks happened to a clergyman during the delivery of his sermon; the other to a literary man while speaking in a public assembly. In both cases a large quantity of blood was found extravasated within and upon the brain. Dr. James Gregory used to mention a patient of his, an officer in the army, who had apoplexy, and in whom the attack had been preceded by pains of the head, and giddiness, upon his giving the word of command, and particularly when dwelling upon the last sound; that is, when he made a long expiration. Precisely of the same kind is a case told by Van Swieten, of a singer who was obliged at length to abandon her vocation by reason of gradually increasing vertigo whenever she had to hold a high note. Violent emotion is another exciting cause. Large fires, crowded rooms, the heat even of the sun, favour the access of apoplexy, and therefore ought to be avoided by those who have a tendency to that disease. The warm bath is not without hazard to such persons. This is so well known, I understand, at Bath, that the physicians there will not allow paralytic patients, in whom the paralysis has been connected with apoplexy—hemiplegic patients, for example—to go into their hot baths. The excitement of drunkenness, and the venereal excitement, are not uncommon causes of apoplexy, especially in old persons. I had a man of middle age under my care during the spring of 1837, in whom a most awful attack of apoplexy came on under circumstances such as I have just alluded to. He had dined at a large festive party, and afterwards accompanied a woman with whom he was acquainted to a brothel; and he was struck with palsy during the act of intercourse. He was long unable to speak; and he still remains, and probably will ever remain, a cripple: incompletely hemiplegic.

I have been since consulted upon the case of an old gentleman residing in France, in whom an attempt at sexual connexion was attended with similar consequences:

> The Gods are just, and of our pleasant vices
> Make instruments to scourge us.

Posture again has no small effect upon apoplectic people. Giddiness, and some degree of confusion of thought, are apt to be occasioned, in most persons, by long stooping. There is one peculiar posture or position mentioned by Dr. Fothergill as being very unsafe, especially for short-necked persons—viz., that position which is assumed when we turn the head to look backwards for any length of time without turning the rest of the body; in fact, a twisting of the neck. In this attitude the jugular veins are more or less obstructed. He gives an account of a man who was seized with apoplexy as he was crossing the Thames in an open boat: he having kept his eye upon a particular ship until, and after, he had been rowed past her. On the very same principle tight ligatures worn about the neck, and compressing the jugular veins, may bring on apoplexy; the wearing a tight neckcloth, for example. A continental writer informs us that a Swedish officer, who was desirous that his men should look well in the face, required them to wear tight stocks; and the consequence was that in a short time a great many in that regiment died of apoplexy. A similar unwise requirement in our own army regulations has of late, I believe, been abolished. Dr. Abercrombie quotes from Zitzilius the case of a boy who had drawn his neckcloth very tight, and was whipping a top, stooping and rising alternately. After a short time he fell down apoplectic. The neckcloth being loosened, and blood drawn from the jugular vein, he speedily recovered.

There is one very powerful exciting cause of apoplexy, in those predisposed to it, which I need only refer to now, because the facts that have been observed in proof of its agency were fully detailed in a former part of the course; I mean exposure to cold. You will recollect my telling you that the number of deaths in London from apoplexy and palsy in the month of January, 1795, which was a bitterly cold month, very much exceeded the number in the month of January, 1796, which was a remarkably mild month. The cold operates in two ways, in the production of apoplexy. In the first place it drives the blood from the surface, and accumulates it in the large vessels of the interior of the body, and so increases the stress upon the cerebral arteries. And in the second place, the cold has a great influence in causing or aggravating affections of the *chest*; and the return of the venous blood from the head is impeded, in the manner just now explained, by fits of coughing and obstructed respiration.

This influence of external cold, and probably certain barometric conditions also of the atmosphere, help to explain, what I am sure I have several times had experience of, namely, the epidemic prevalence, now and then, of apoplectic seizures.

Half a century ago, when my medical education began, the *treatment* of a *stroke*, whether apoplectic or paralytic, was for the most part a matter of melancholy routine. Practitioners were (and are) too apt, in this as in other instances, to be guided in their choice of remedies by the *name* of the disease; and so to treat all cases of apoplexy alike. I remember being amused by the perplexity which a friend of mine, long since dead, told me he had felt on being summoned by letter many miles into the country to see a gentleman who had been struck with apoplexy. This was before railways or telegrams were. As he posted down he earnestly revolved in his mind what he might be able to advise when he should reach the house of sickness. He felt confident that the patient must already have been copiously bled; cupped, or leeched; blistered; and thoroughly dosed with calomel, senna, and croton-oil. Mustard poultices had doubtless been applied to his legs. My friend was distressed to think that while much would be expected, nothing would be left for him to do worthy of so long a journey, and so heavy an expense to his client. A clyster of turpentine might yet, perhaps, be an untried expedient. His cogitations were cut short, however, and his cares relieved, by an express which met him half-way on the road, to announce that the patient was dead. Now this is the routine to which I have alluded.

But 'we have changed all that.' M. Trousseau, the great French clinical teacher, recently dead, had long abandoned and deprecated any kind of bleeding or depletion in apoplexy; and a discreet and able physician among ourselves 'never prescribes any medicine but croton-oil by the mouth.'

Between the *nimia* and the *exigua diligentia medici* thus exemplified, lies, I apprehend, the juster mean.

Our method of treatment is likely, in any case, to be rational and right in proportion to the accuracy of our diagnosis; and of late years our special diagnosis, in apoplexy, has become much more exact and certain.

In all these attacks, the main question to be settled is whether blood should be taken; a question of the last importance—involving often (as Celsus taught) the alternative of life and death: 'Sanguinis detractio vel occidit, vel liberat.'

You may find your patient unconscious. But insensibility and unconsciousness are common to both syncope and coma; and cases which fall under the class of apoplexies, and which we cannot separate from that class, are sometimes, as I have told you, more like cases of concussion of the brain than anything else; the shock having been of internal instead of external origin. If, then, the unconscious patient's skin be cold and pale, his pulse feeble, his aspect pinched and bloodless, his breathing faint perhaps, but regular and easy—no good, but the contrary, can be expected, under these circumstances, from blood-letting of any kind. It might even ensure the patient's death—the sanguinis detractio would be destructive. You will do better to apply warmth, cautiously, to the surface, and cautiously to administer what are called diffusible stimuli, of which the preparations of ammonia afford the most eligible forms. Five grains of the sesquicarbonate, or half a drachm of sal volatile, mixed with camphor julep, are ordinary doses. Stand by till the first stunning effect of the internal shock passes off; and carefully watch meanwhile for symptoms of reaction.

But if, with profound coma (there being no suspicion of alcoholic or other poisoning) you notice embarrassment of the breathing, slow snoring respiration, with the outward marks of great venous congestion, loaded and livid features, distension and prominence of the superficial veins of the neck and forehead, you may conclude that danger is impending through the lungs; the automatic, as well as the voluntary movements of respiration being impeded or suspended by the cerebral tumult and pressure. When this fearful state is present, a guarded trial of venesection will, in my judgment, be the right practice. The patient should be placed in a semi-recumbent position, with his head and shoulders raised; any tight parts of his dress, especially his neckcloth and shirt collar, and whatever might press upon the neck, should be loosened, and then as quickly as possible a vein should be opened in his arm. In all probability there is a large extravasation of blood compressing directly or indirectly the medulla oblongata. Now we never can tell how much blood has been poured out, nor can we ever know the exact limit, as to quantity, within which recovery may be possible, and beyond it impossible. We are bound to act on the most favourable supposition. If recovery be already impossible we do no harm by our blood-letting; but we embrace the chance—by easing the gorged right ventricle of the heart, and freeing in some measure the obstructed lung—of giving the stunned brain time and opportunity to rally from the first shock of the hæmorrhagic blow; an opportunity which an abiding block to the circulation would infallibly prevent and defeat. Here the sanguinis detractio may possibly save life. Sometimes the good consequences of bleeding in such cases have been very marked indeed, so that no doubt of its propriety could be entertained; the patient having been so insensible as not to feel the prick of the lancet, and yet emerging from the coma while the blood was still flowing. It is seldom, however, that we can expect amelioration so immediate and unequivocal as this.

Should the pulse fail, or the face become pale, while the blood is escaping, the vein must instantly be closed.

Even in circumstances somewhat less threatening and urgent, if his face were flushed and turgid, and his head hot, I would apply cupping-glasses to the nape of the neck, or leeches behind the ears, of the apoplectic patient. Any addition to his danger in such a predicament, from such a remedy, I hold to be quite visionary and unreal; and we ought not to neglect even a chance of rescue. Of course I should cherish more of hope from such topical bleeding, if the patient were not old, and no evidence presented itself of wide-spread tissue-changes.

Whatever may be thought or said as to the propriety of abstracting blood, you need not entertain any doubt or hesitation about giving purgatives, which are of signal service in apoplexy. They empty the intestines, which are oftentimes loaded, and which by their fulness and distension have occasioned, perhaps, undue pressure against the diaphragm, embarrassed the breathing, and through it the cerebral circulation. Another very important purpose of hard purging, which I have frequently pointed out before, is the procuring of copious watery discharges from the bowels; whereby the blood-vessels are drained, and the tendency of blood to the head especially relieved. If the patient can still swallow, you may give him half a scruple of calomel, and follow it up by a black dose. If the power of deglutition be lost, the croton-oil becomes a most valuable remedy. Dr. Abercrombie suggests that it may be conveniently introduced into the stomach, suspended in thick gruel or mucilage, by means of an elastic gum tube. But really that is not necessary. If two or three drops of the oil be put upon the tongue, as far back as is possible, it will produce its specific effect very readily and well. But we are not to wait for the operation of aperients given by the mouth. Strong purgative and stimulating enemata should be thrown into the rectum: half an ounce, or six drachms, of turpentine, suspended, by the help of the yolk of an egg, in gruel or warm water. We very often witness decided signs of amendment upon the free operation of a purgative. I may mention one instance of this while it is fresh in my recollection. I was asked a few evenings ago by a medical friend, to see an old General, a patient of his. I found him in bed, comatose, though capable of being roused when loudly spoken to; but he presently fell off again into stupor. His respiration was peculiar. For a minute or two he would breathe, snoring strongly; then the breathing would cease altogether for half a minute or thereabouts; and then the stertorous respiration recommenced: and so on alternately.

He had been found by his servant on the floor, nearly insensible, in the morning, having fallen either out of his bed, or upon rising from it. He had very properly been cupped; and calomel and aperient medicine had been given: but the coma had been growing more profound all the afternoon. His bowels had been but scantily moved; and the fæces and urine were passed as he lay. His extremities were coldish. The pulse was neither full nor strong.

I learned that for four or five years he had had some very significant warnings; and within that period had suffered one or two slight apoplectic seizures, which had left him with impaired mind and memory.

I prescribed two drops of croton-oil with two drachms of castor-oil, in a draught, which he was able to swallow. I expected to hear the next morning that he was dead; but I found him quite conscious, speaking somewhat inarticulately, with the right side of his face chapfallen and inexpressive. There seemed no particular weakness of the corresponding extremities. The oils had been followed by copious evacuations from the bowels. The day afterwards he was sitting up, and so well, that I took my leave.

In combination with blood-letting and purgatives, cold lotions to the head are often found useful in this disease, especially if its surface be hot. I need not trouble you by rehearsing the modes in which the application of this remedy may be managed. Blisters near or upon the head, seem sometimes to be of service in rousing the patient from his state of coma.

Formerly, at the suggestion, I fancy, of Dr. Fothergill, it was much the fashion to give an emetic in the outset of the treatment of apoplexy. But this is a ticklish remedy, capable of doing good or harm according as it is well or ill timed. If there be already extravasation of blood, or even plethora capitis, the act of vomiting will be likely to increase the existing mischief, and to enhance the danger. On the other hand, it may rouse and rally the nervous power when the patient is pale, and cold, and faint. Yet this can never be regarded as a legitimate purpose of emetics in apoplexy. They can safely be recommended in those cases only, in which the coma may appear to depend, wholly or in part, upon a loaded stomach. Hence the propriety of giving an emetic will deserve consideration whenever an attack of apoplexy follows close upon a heavy meal.

When the immediate danger has passed by, and paralysis remains, we are not to be over busy. If the palsy is to get gradually well, it must be by virtue of time, and the resources of nature. I should prescribe aperient medicines, so as to keep the bowels freely open once or twice a day; enjoin perfect quiet; and put the patient upon very short commons. Diuretics are also proper when the urine is not plentiful without them.

When hemiplegia happens, without previous or subsequent loss of consciousness, and without fever, it is the result, in all probability, of white-softening and disruption of the brain-fibres, with or without a *small* effusion of blood. In such cases the starved organ must by no means be further drained of its nutritive blood. Absolute repose, the screening of the damaged brain from all disturbing influences, mental, moral, or material —from harassing thoughts therefore, from strong emotions, from bodily efforts; a full supply of nutritious food; sustaining medicine sometimes, such as cod's liver oil with phosphate of iron; these means comprise all that can rationally be attempted. Hard purging, in these conditions, would be injurious.

You will often have to contend against the ignorance and impatience of the sick, or of their friends, on these occasions. They think that *weakness* is to be redressed by *strengthening* remedies, quinine, strychnine, brandy in plenty, and a high meat dietary: or if they are not so foolish as this, they will want to be electrified, or to be put into a warm bath. Certainly in the earlier stages of the palsy that remains after apoplexy, none of these things ought to be permitted. Attempts to urge the hurt brain into action again by such means, would be both vain and unsafe. But a secondary evil is apt to ensue, which may in some degree be obviated. During the period in which the moving power is dormant, the machinery of motion may fall from disuse into decay. Muscles that remain long unexercised, wither; and wither for that reason. They undergo the one, or the other, or both, of the two species of atrophy so well described by Mr. Paget. Either they simply dwindle in size, or dwindling they degenerate also in texture. This last is the more common change. The muscle is then spoiled for its purpose; and no longer capable of resuming its contractions, upon the restoration of the nervous influence. It is probable, as Mr. Paget ingeniously suggests, that in some, at least, of the cases in which the paralysis abides after every other indication of disease in the nervous centres has passed away, the residual fault lies really in the instruments of motion, the muscles. He adverts to the experiments of Dr. John Reid, which show that the loss of contractile power in a palsied muscle is owing directly to its imperfect nutrition, and only indirectly to the severance of its connection with the nervous centres. Dr. Reid divided the nerves of a frog's hind legs—and leaving one limb inactive gave the muscles of the other frequent exercise by galvanising the lower end of its nerve. The result was, that at the end of two months the exercised muscles retained their weight and texture and their capacity of contraction; while the inactive ones had lost half their bulk, were degenerated in texture, and had also lost some of their power of contracting.

In other cases also he found, that degeneration of texture in the unused muscles always preceded the loss of their contractile power. It will be proper, therefore, in cases of protracted paralysis, to promote, and if possible maintain, the nutrition of the idle muscles, by friction and pressure, by shampooing, by calling them repeatedly into artificial exercise through the stimulus of galvanism or of electricity. Our aim must be to preserve the muscular part of the locomotive apparatus in a state of health and readiness, until, peradventure—that portion of the brain from which volition proceeds having recovered its functions, or the road by which its messages travel having been repaired—the influence of the will shall again reach and reanimate the palsied limbs. If, however, no such repair or recovery should ensue, then, at length (as Mr. Paget tells us, on the authority of Dr. Turck), 'those tracts or columns of the cerebro-spinal axis through which in health impressions were habitually conveyed from the diseased part' will themselves slowly and gradually undergo a softening, as by atrophy. In the more chronic cases we may sometimes benefit our patient's general condition by the cautious exhibition of some of the preparations of iron.

I have still to speak of one other distinct form of disease, which has been ranked, rightly or wrongly, among the apoplexies. It was barely mentioned, in an earlier lecture of this course, as the sun-stroke, *coup-de-soleil*, insolation, or heat-apoplexy. What I have further to say on this disorder may as well be said now.

It has been fully ascertained that its exciting cause is an extreme degree of atmospheric heat: and its essence appears to consist in an overheated condition of the body and of the blood. Hence, though in our hottest summer weather insolation occurs occasionally in this country, it is very much more common in tropical climates. The popular notion is that it is caused, as the trivial name, sun-stroke, imports, by the direct and fierce incidence of the rays of a hot sun upon the sufferer's head. And it may sometimes be so produced; but almost always predisposing causes have been in operation, and other exciting causes have concurred.

Sometimes the actual onset of the disorder is sudden—so sudden as to suggest and justify the idea of a stroke. The patient falls down, as if struck by lightning, says one witness, gasping and unconscious; and dies outright, before anything can be done to rescue him. In other cases there are warning symptoms of what is about to happen, giving time for the trial of remedies: faintness, giddiness, nausea, a pink congestion of the eyes, delirium sometimes, a frequent desire to make water, and even some degree of incontinence of urine. In all cases there is burning heat and extreme dryness of the skin; the temperature of the body rising often to 107° Fah.

The disorder is incidental to labourers in the fields, to troops engaged in long marches under a scorching sun; or during the continued blowing of the hot land-winds of the tropics. The exercise, while it exhausts the store of nervous force, increases the natural warmth of the blood; the high temperature of the surrounding air precludes the due radiation of heat from the body; there is no perspiration, which should naturally tend to cool it by carrying off the superabundant heat: so that, at last, the internal heat of the tissues and of the blood, if not speedily remedied, becomes incompatible with the continuance of life.

To my mind the actual phenomena present the characters of the unconsciousness of syncope, rather than of coma. One of Sir Benjamin Brodie's experiments tells in favour of this opinion. He placed a rabbit in a basket, in an oven the temperature of which was not higher than 150°, and it died in a few minutes without any apparent suffering. The heart was afterwards found to be full of blood on both sides; as after death by asthenia.

Exposure to the direct beams of the sun is by no means the sole cause, or the necessary precursor, of heat-apoplexy. The same morbid condition has often been witnessed when there had been no such exposure. It has found its victims among men shut up in the impure as well as heated air of close barracks, and less frequently in crowded ships, in hot climates. And there is good evidence that the effects of the high atmospheric temperature were often aided and aggravated, not only by fatigue, but by the tight, heavy, cumbersome, and otherwise unsuitable dress and accoutrements which, formerly, our soldiers were compelled to wear.

I am unable to assign, with any confidence, the *cause* of the absolute dryness of the skin in these cases; but the frequent and abundant micturition is obviously one of its *consequences*. It has been said that chronic eruptions of the prickly heat disappear when the disorder is present, or approaching.

Death may take place, as I have said, in a few minutes: or the symptoms may continue and end fatally in thirty or forty hours. After death the blood remains fluid; and all the writers who speak from actual experience concur in declaring that the lungs are always found full of dark blood, nay enormously congested, and that the right chambers of the heart are distended. Dr. George Johnson indeed, from whom any suggestion in respect of pathology must command respectful attention, has expressed the opinion that this formidable disease might be more fitly named heat *apnœa*; and he offers the following explanation of the phenomena which it presents. 'The hot blood relaxes the muscular walls of the minute pulmonary arteries. The pulmonary capillaries are consequently flooded with blood. This overfulness of the capillaries interferes with the aëration of the blood. In fact, the overgorged vessels must encroach upon the pulmonary vesicles, and so diminish the air-space within the lungs; while the air itself is highly rarefied. Hence a state of more or less complete apnœa. Unaërated blood is sent to the muscular tissue of the heart, and to the brain: hence the cardiac and the cerebral symptoms. A similarly engorged state of the cutaneous capillaries, consequent upon extreme relaxation of the minute arteries, is the probable cause of the dryness of the skin. An excessively gorged state of the capillaries is as unfavourable for cutaneous secretion as it is for pulmonary respiration. The dry and inactive state of the skin and the want of surface evaporation, tend to elevate still more the temperature of the blood: and the suppressed cutaneous secretion, being diverted to the kidneys, probably alters the quality of the urine, renders it irritating to the bladder, and explains the frequent micturition.'

It was formerly the custom to bleed the patients who were suffering from sun-stroke: but this treatment was gradually acknowledged to be disastrous. The natives of India were always in the habit of pouring cold water upon their heads; and the modern experience of our army surgeons has vindicated and confirmed the wisdom of that practice. They find, also, that when consciousness, and the power to swallow, have been thus restored, it is better to give some moderate stimulant—rum and water for instance—than to use any form of depletion. I have been told, on good authority, that in his Indian campaigns, Sir Hugh Rose always took with him on his marches an ample supply of water, and that whenever he felt impending the well-known precursory symptoms of sun-stroke, he caused himself to be sluiced, head and body, with gallons of the water, and soon recovered. It seems borne out, by adequate testimony, that, as a rule, of those seized, they who are bled and purged die, and they who are douched, escape death. At the taking of Rangoon, under extreme heat, there were numerous cases of so-called sun-stroke. English officers so affected were taken to the hospital. Those who belonged to troops of the line had been treated after the old manner, by blood-letting: they all died. Those who belonged to the Indian troops had been treated by cold affusion to the head: they all recovered. For this fact I am indebted to Dr. Christison.

The cold douche, then, is the principal remedy. Of course the patient should be divested of all tight or heating garments. Dr. Johnson recommends, if the breathing be rapid and laborious, that his body should be wrapped in a wet sheet; and that evaporation should be quickened by a fan, or by bellows. Iced water should be freely administered by the mouth if the patient can swallow, and injected into the rectum. 'As hot air and hot blood are the causes of this form of apnœa, so cold air and cold water are the chief means of cure.'

Although the brain-substance is not broken by cerebral hæmorrhage, nor its fibres severed by softening, it is plain that that organ is profoundly hurt, even when the disease does not immediately kill. They who recover are scarcely ever the men they were before: they are subject to abiding headaches, lose their memory and the force of their intellect, become weak, incapable, fatuous, and sometimes even paralytic.

LECTURE XXVI.

Spinal Hæmorrhage. Paraplegia. Facial Palsy and Facial Anæsthesia; their Symptoms, Prognosis, and Treatment. Other Forms of Local Paralysis, and Local Anæsthesia.

I HAVE done with apoplexy as it respects the brain; which is the same thing as to say that I have done with apoplexy. You will find the same term applied, indeed, to effusions of blood in other organs of the body; but this use of the word is, I repeat, a perversion of language. Apoplexy, as I have frequently observed before, means the abolition of the functions proper to the *brain*; of sensation, voluntary motion, and thought. In short, it is coma, coming on under certain circumstances.

I shall not speak therefore of *spinal apoplexy* (though that would be less improper than *pulmonary* apoplexy, or *hepatic* apoplexy), but of *spinal hæmorrhage.* Of this I really have little to say, except that it is well known occasionally to occur; and that the symptoms to which it gives rise are by no means peculiar or distinctive. They consist of *pain* in some part of the spine; *convulsions*; *palsy*: that is, they are the very same symptoms which inflammation, softening, mechanical injury, and other disorders of the same part may produce. Spinal hæmorrhage is much more rare than cerebral hæmorrhage. Dr. Abercrombie had met with only one case of it. He gives the heads of seven others which have been recorded by different authors. Dr. Bright had never seen it: but he published the particulars of one case, which were communicated to him by Dr. Stroud.

I will read you one or two short examples of spinal hæmorrhage, as specimens. A girl, fourteen years old, was attacked with headache, *pain in the back,* and a tendency to sickness when in the erect posture. At the end of a week the pain in the back became suddenly and very greatly aggravated; and this was followed by general convulsions, which proved fatal in five or six hours. The spinal canal was found filled with extravasated blood, in the lumbar region, where she had felt the pain. The brain and all the other viscera were sound. The case is detailed by Mr. Chevalier in the third volume of the 'Medico-Chirurgical Transactions.'

Take one more instance from Ollivier, whose work on the spinal marrow you may read hereafter, when you have leisure, with advantage.

A gentleman, aged sixty-one, had just arrived in Paris after a long journey, when he was seized with *pain in the back*, all the way down from the cervical vertebræ to the sacrum. In the course of a few hours he became paraplegic, and was unable to retain his urine or fæces. He then sent for a physician, and died while talking to him. A very extensive extravasation of blood was found in the spinal canal, beneath the membranes of the cord. The lower part of the canal was filled with a bloody mass, in which the substance of the cord could not be distinguished. Above the third dorsal vertebra the cord was entire, but of a deep-red colour, and very soft.

I used to fancy that the *suddenness* of the symptoms might warrant a suspicion of the true nature of these cases; but a very interesting instance of fatal hæmorrhage into the spinal canal, occurring gradually, and accompanied neither by pain, nor by convulsions, has recently been recorded by Dr. Robert Jackson, with whom Sir William Jenner also saw the patient in consultation.

A girl of fourteen, previously healthy, began, on May 2, 1869, to experience some weakness in her fingers. Two days afterwards, not feeling otherwise ill, she was unable to shake hands with Dr. Jackson, or to move her arms except at the wrists. She could not pick up a pin from off a book that lay before her. Then it was noticed that her intercostal muscles did not act quite freely, she was less able to turn in bed; and moist sounds began to be audible in her lungs. By degrees the muscles of respiration, and those of the arms, back, and chest supplied by branches of the cervical nerves, lost their power; and the diaphragm became fixed. On the sixth day she died, without pain, or loss of consciousness or of sensation, but by gradual failure of the respiratory movements; expressing her desire to be raised higher and higher.

Slight opacity of the dura mater in some places was found after death, and a soft and well-defined clot in the cerebellum. Sir William Jenner had given the diagnosis of spinal hæmorrhage. The whole cervical portion of the spine, but especially its front and its left side, was imbedded in an oblong clot of dark venous blood, lying outside the membranes. The cervical nerves all passed through this effused blood, the intervertebral canals on both sides being filled with it. The clot ceased at the beginning of the seventh cervical vertebra. There was a good deal of half-clotted blood about the pons Varolii, and the nerves that arise from it.

As hemiplegia, which divides the body longitudinally, belongs mainly to the encephalon, so *paraplegia*, which divides it transversely, belongs mainly to the spinal cord.

The cause of this kind of palsy is sometimes obvious; sometimes most obscure. If we find, in the spinal canal, blood effused, softening of the substance of the cord, traces of inflammation of its investing membranes, tumours occupying it or pressing upon it, pressure from disease or displacement of the bones, we have a sufficient explanation of the paralysis of those parts of the body, the nerves of which come from the spinal marrow at or below the place of the disease. There are three preparations on the table, of tumours that pressed upon the cord; scrofulous tumours I believe they are: each of the three persons from whose bodies they were respectively taken was more or less completely paraplegic.

But in many cases we detect no alteration that seems adequate to explain the paraplegia. The palsy creeps on slowly and insidiously, without any particular pain or violent symptoms: there is no tenderness or bending of the vertebræ. The weakness commences mostly in the legs, which appear to the patient heavier than usual, and of which the healthy sensations are often perverted. The toes tingle, or are numb: he experiences a feeling in them as if a number of ants were crawling on the skin. This is so common a circumstance as to have given a name to the symptom, *formication*. The patient straddles as he walks. His legs are lifted awkwardly, the toes being often the last part to quit the ground: they are then flung obliquely forwards and outwards, and the feet flap down heavily and uncertainly at every step. By degrees the weakness of the lower limbs increases: the palsy creeps upwards, affects the bladder and rectum, and the muscles of the abdomen, at length invades the arms, and ultimately the patient dies: yet very faint traces of disease, or no traces at all, may be visible, by the naked eye at least, upon inspecting the brain and spinal cord. The commonest morbid condition is *softening* of some portion of the cord; and this is also the condition which is the most liable to be overlooked. Dr. Gull describes a case of paraplegia, and it is probably a sample of many more, in which it was only by the exercise of great patience, and after repeated examination, that even the microscope disclosed traces of inflammatory exudation in the cord; but these, though slight in amount, were distinct and decisive.

It is in cases of paraplegia that you may look to witness the very remarkable phenomena which I mentioned before as evincing the separate existence of a 'true spinal marrow,' distinct from the brain, endowed with special and peculiar properties, and performing functions that are independent of sensation, of consciousness, and of the will. If you pinch or tickle the surface of the paralytic members, or apply a hot spoon to the sole of one foot, the limbs will, in many cases, start up and move strongly, not only without any voluntary effort on the part of the patient, but in spite of him; and even (in those instances in which there is anæsthesia as well as palsy) without his knowing it. The legs often spring up *of their own accord* as it *seems*; but, no doubt, the apparently spontaneous movement is really an excited movement, and takes place in obedience to the laws that govern the automatic motions of the body. Some impression, made first upon the peripheral extremities of afferent nerves, runs through the nervous arc of communication, and exhibits its ultimate effect at the extremities of the corresponding efferent motor nerves. We can imagine many such accidental and unsuspected sources of excitement; a casual touch, the varying contact of the bed-clothes, the bite of a flea for aught I know to the contrary, may suffice. Even the passage of fæces or of flatus along the lower bowel, or of urine through the urinary passages, may be enough (as we are taught by unquestionable facts) to produce these movements. They are more readily excited, *cæteris paribus*, in proportion as the interfering influence of the will, or perhaps it would be safer to say, of the cerebro-spinal axis lying above the seat of the disease, is more completely cut off.

I knew a gentleman, who had retired from the medical profession, and who, though not paraplegic, laboured, I believe, under some morbid condition of the spine. He had been, in early life, a hard drinker, and had suffered delirium tremens. Every night, sometimes more than once or twice, the trunk of his body, and all his limbs, became for a while fixed and stiff, from rigidity of the muscles. A few days before his death, he told me this curious fact. Whenever he scraped his shoes on the scraper at the door, his leg flew up, with a spasmodic suddenness, from the iron, notwithstanding his endeavour to prevent it. He died suddenly. I believe he was found dead in his bed.

In some cases of paraplegia, involuntary retractions of the palsied limbs can be excited; in some cases they cannot. When any influence from above is quite excluded by the operation of disease affecting the spinal cord itself, then is the susceptibility of excited movements the most lively. But the increased susceptibility is limited to that portion of the body, the nervous arcs belonging to which lie beyond the seat of the disease; more distant, I mean, from the brain. Hence it follows that we may determine, approximately, the place of the disease, by the test of these reflex actions. The mischief may be situated, or may extend, so low down, that there are no uninterrupted nervous arcs below it. Supposing it to lie as low as, or to reach, the commencement of the cauda equina, we should have no involuntary movements. Conversely, when no involuntary movements can be excited, the spinal disease is, at least, as low as the upper lumbar vertebræ. Thus, I say, we have another mode, in addition to those pointed out in a former lecture, of determining, in a given case of spinal palsy, whereabouts, or to what extent, the cord is implicated in the disease.

We do not so often observe these reflex movements in cases of hemiplegia; apparently for this reason, that in hemiplegia the sensorial, or the higher, influence is not, usually, so completely shut out as it is apt to be in paraplegia. Yet I have seen some of these phenomena in several hemiplegic patients. One of them, for example, whose right hand and arm were quite passive under the strongest efforts of his will to stir them, took notice himself, as did his nurse, that whenever he yawned and stretched himself, the fingers of the palsied hand participated in the action, opened outwards, and were thoroughly extended: and I could, by tickling the sole of his foot, excite some starting of the leg, long before any power of voluntary movement returned. This is by no means uncommon.

Dr. Hughlings Jackson told me this interesting fact. He was looking at the optic disc of a man whose closed and paralytic hand moved in this way while he was yawning; and at the same instant the blood-vessels of the disc were emptied—to refill again at once. May not, he asks, some like effect be produced, at these moments, in the blood-vessels of the corpus striatum, and so the movement be, in some sort, accounted for?

With the loss of power there is usually more or less of anæsthesia: the limbs are numb; or feel as if they were swathed in bandages. Sometimes they are totally devoid of sensibility, so that the patient, lying in bed, does not know, till he lifts up the bed-clothes, whereabouts or in what position his legs are lying.

In the earlier stages, or less complete forms, of paraplegic disorder, *this* curious symptom has often been noticed. The patients walk worse, or cannot walk securely at all, *in the dark.* Not *seeing* where they place their feet, they do not know where they place them; and in default of the natural sense of muscular resistance, they fail to keep the centre of gravity within the requisite limits. This is a notable symptom of the disorder called *locomotor ataxy.*

Do not forget the important fact that, in many, nay in most cases of paraplegia, the urine at length becomes ropy, stinking, ammoniacal; and that the bladder, after death, presents appearances such as chronic inflammation might produce; roughness and redness of its inner surface, and thickening of its coats. What is the order of these changes, and in what relation do they stand to each other? Is the quality of the urine first altered, and does the bladder then suffer from the perpetual contact of this unnatural secretion? or does the bladder become diseased in consequence of the palsy, and pour forth unhealthy mucus, whereby the quality of the urine is affected? The truth I believe to be implied in the latter of these questions. You will find, in many cases, when the urine voided is alkalescent, that if the bladder be washed out by the injection and withdrawal of warm water, and then the next portions of urine that descend from the kidneys are immediately removed and tested, this freshly secreted urine will be acid. So also, after death, the urine has proved to be alkaline and mucous in the bladder, acid in the healthy pelvis of the kidney. Dr. Bence Jones, in the 'Philosophical Transactions' for 1845, has some excellent observations on this subject. He finds that, in such cases as I have been speaking of, the alkalescence of the urine is always due to the presence of carbonate of ammonia. It arises from the decomposition of urea by altered mucus. The urine makes reddened litmus paper blue, but the red colour returns as the paper dries. The blue would be permanent if produced by a fixed alkali in the urine. Moreover, pus globules are always to be detected by the microscope in the secretion, before it becomes ammoniacal and ropy. While the urine continues acid, any pus which may be mixed with it retains its natural appearance, and fluid condition. Its globules remain distinct, and do not adhere to each other. But whenever the urine becomes alkalescent, the carbonate of ammonia, acting upon the pus globules as the liquor potassæ might do, causes them to stick together: so that a stringy viscid matter is formed which includes epithelium, ammoniaco-magnesian phosphate, and granules of phosphate of lime. 'All these together constitute the ropy mucus seen in cases of diseased bladder.' There seems to be some connection between an inflamed condition of the mucous membrane of the bladder, and the state of the spinal cord. Dr. Bence Jones calls attention to the fact, that sloughing of the external integuments is common in the palsied parts; and suggests that the internal integument of the bladder suffers some analogous change, whereby the urine is at length rendered ammoniacal. It is said, however, that in some instances of paraplegia, the urine has been *secreted* alkalescent. If these cases have been accurately noted, you may conclude that the pelvis of the kidney was also the seat of disease, and such disease may perhaps have been propagated from the bladder, backwards. Or the disorganisation of the bladder, and the alkaline quality of the urine, may both have been common results of the interruption of the nervous influence.

In some of these cases of paraplegia the defect seems to be merely what is called functional; independent, I mean, of any such change in the nervous matter of the cord as is cognisable by our senses: though some change there must be. It may be brought on by various causes, chiefly of an exhausting kind: by cold; by intemperance in drinking; by excessive sexual intercourse; or, still more surely, by self-abuse. I have had the last cause assigned to me voluntarily by patients themselves. In such cases the functions of the spinal marrow flag and fail; but may yet be capable of reanimation. But there is another way in which paraplegia may be accounted for, although its physical cause is very liable to be overlooked. It may result from serous effusion into the spinal canal; which effusion may have originated *there*, or what seems sometimes to be more probable, may have been poured out *within the cranium*, and descended by the force of gravity to the lower part of the cavity of the spine. Dr. Baillie read a paper on this subject before the College of Physicians: it is contained in the sixth volume of the 'Medical Transactions.' He was not the first person to whom this mode of explaining certain obscure cases of paraplegia suggested itself; but he was the first I believe who published upon it. This effusion may very readily be overlooked. Commonly the brain is examined first; and no great attention is paid to the escape of fluid from the vertebral canal. It would be better to lay open the spinal cavity first, at its lowest part, and to puncture the theca, and then to observe what quantity of fluid runs out when the body is placed upright. There *should* be a *certain* quantity; but if *much* serum so escaped, we might conclude that it had existed in hurtful abundance during life, and had probably caused the paraplegia. In most of these obscure cases you may trace *some* head symptoms; giddiness, transient confusion of thought, loss of memory; and it really will be worth your while to make the examination in the way I have pointed out, whenever you have occasion to inspect the body of a patient who has died paraplegic. In most cases, however, of decided abolition of the power to move the lower limbs there is material and visible damage of the nervous matter.

Paraplegia has been ascribed to some primary morbid condition of the *nerves* which belong to the spinal cord. That the functions of the *efferent*, or motor, nerves may be impaired, and even arrested, by exposure to cold, and by other injurious influences, is both possible and probable. But a diseased or disordered state of the *afferent* nerves has been assigned as a cause of the palsy. This is less clearly conceivable. Coexisting disease of the kidneys, and coexisting enteritis, have been thought sufficient to account for a paralytic condition of the lower limbs. The extremities of certain incident nerves being affected, a morbid impression is transmitted to the cord, suspensive of its central function. The efforts even of volition, which come from the brain, are no longer successful. Such is the theory. These, it is said, are cases of *reflex* or eccentric paralysis, as distinguished from centric paralysis resulting from disease in the cord itself. But Dr. Gull has advanced good reasons for doubting whether it be a correct theory. That there is such a disease as *urinary paraplegia*—by which is meant paraplegia set up by disease beginning in the urinary organs—is unquestionably true, but I believe with Dr. Gull that it mostly arises from the extension of *disease* through continuous structures to the cord itself. He inclines to ascribe much of the mischief in these cases to the meddlesome interference with a diseased bladder by the use of the catheter, under the hope of removing some hypothetical cause of reflex irritation. The comparative freedom of women and of children —who are liable enough to calculus and consequent irritation of the bladder—from urinary paraplegia, lends strength to this suspicion.

We should also beware lest we ascribe paraplegic symptoms to disease in the bladder or kidneys that may indeed have preceded those symptoms, yet was, in truth, merely an earlier consequence than the paraplegia of disease in the cord. There are two facts which, in the consideration of this question, should never be forgotten: first, that morbid conditions of the kidneys and bladder are *constant* and early results of paraplegic disease of the cord; and, second, that structural disease of the cord may escape detection, however narrowly it be looked for by the naked eye. Of this I shall have to give you distinct evidence in the next lecture.

Dr. Gull lays down some useful points of distinction between different forms of paraplegic disorder. As in hemiplegia from local disease in the brain, so in paraplegia from local disease in the spinal cord, the motor functions are more often and more extensively impaired than the sensory: the palsy is almost always more decided and more abiding than the anæsthesia; and often there is no loss of sensibility at all. In those cases in which the anæsthetic condition preponderates, or even sometimes may exist alone, experience teaches us not to expect to find after death any substantial or limited disease of the cord. The disorder in the first instance is of peripheral origin. Its causes (exposure to cold and wet is one of the commonest of them) act upon the sentient extremities of the nerves, the muscular movements of the limbs being subsequently impaired, if they are impaired at all.

I have met with three or four instances of paraplegia, in which the palsy appeared to result from the immersion of the lower part of the body, for some time, in cold water. Thus, in one of them, the patient had been in the habit of wading for hours together, in a river, while fly-fishing. We may reasonably suppose that, under these circumstances, the nerves, rather than the cord, would be likely to suffer. A remarkable example of the effect of cold so applied, in benumbing the sensations of the parts exposed to it, fell under my notice in the spring of 1846. A lady, between 20 and 30 years of age, suffering from slight leucorrhœa, was directed by her physician to use the cold hip bath. Mistaking, I believe, his instructions, she sat in the cold water for twenty-five minutes, on twelve successive mornings, in the month of February. On each occasion she came out of the bath benumbed. At first the numbness was transient; but at length it became permanent. When I saw her the sensibility was nearly extinct, from that level of her body which the cold water reached, downwards. The parts were not quite destitute of feeling, but seemed to her as if muffled. She scarcely knew when her legs touched each other —nor whereabouts they were when she was lying in bed. She walked in an awkward manner, and said that her legs felt large and heavy; and if one of her shoes slipped off, she was not conscious of it. The inclination to make water came suddenly, and with hurry, and the urine sometimes escaped from her unawares, and she had no sensation that it was passing. Her bowels were never relieved without the aid of purgatives, and then with similar haste. The pulse was plainly to be felt in the tibial artery. There were no head symptoms.

I have related this case chiefly for the sake of mentioning the remedy to which it ultimately yielded. When warm baths, friction, blisters, and stimulants of various kinds had been tried in vain, Mr. Christophers, who had called me to see the patient with him, had recourse to electro-magnetism. After the second application, improvement became manifest; and in about three weeks the sensibility was completely restored, and the lady well.

Cases of paraplegia, such as I have been describing, are by no means uncommon. They are usually slow and tedious; and you will be called upon to administer to their relief. I need not repeat the caution which I have several times given, in regard to the condition of the bladder; you must take care that it does not become over-distended with urine; and you must enjoin strict attention on the part of the nurse to keeping the patient clean and dry. Friction along the course of the spine; blisters to the loins or sacrum, frequently repeated; issues; and electricity: all these means you will generally have opportunity enough for trying, and for regretting their inutility. In such cases it may sometimes be warrantable and proper to employ strychnia: a poison which mainly affects the spinal cord; causing, when given in a sufficient dose, tetanic spasms of the limbs, with very little or no affection of the sensorium. I have heard of some striking instances of recovery from paraplegia under the exhibition of this drug. I wish I could tell you that I had ever *seen* such. Let me caution you against its indiscriminate use; or rather its abuse. No good can reasonably be expected from it, but much harm, unless the cord be free from organic disease. Even then I would not advise you to begin with a stronger dose of strychnia, or of the sulphate or the acetate of strychnia, than the thirtieth part of a grain thrice daily: this may be gradually and cautiously increased, until it gives rise to twitching of the limbs, or to some other obvious effect. The twitching is usually confined to the palsied muscles. This shows that it results from the agency of the remedy upon the excito-motory system, or true spinal marrow; of which the reflex function is always more readily excited when the cerebrum has lost its customary controlling power. When this symptom occurs, you had better go on with the same dose; it would be unsafe to increase it: and the progress of the case will soon inform you whether any benefit is likely to accrue from a continuance of the medicine. A paraplegic out-patient now attending the hospital has taken the strychnia. It made his palsied limbs start and extend themselves; but no permanent power has been gained.

There is one other drug which I should recommend you to try in such cases; viz., the tincture of cantharides. It certainly has sometimes a very beneficial effect. Generally, when it does good, it acts as a diuretic; and Dr. Seymour has thrown out the suggestion that it is most likely to be useful in those cases of serous effusion into the spinal cavity, of *spinal dropsy*, which I just now described. He recommends the tincture as a good diuretic in several forms of dropsy; and supposes that it benefits paraplegia by tending to produce absorption of the serum effused within the vertebral canal.

But there is another principle upon which this medicine may be sometimes advisable. Cantharides are well known to have a peculiar effect upon the bladder; which effect is doubtless produced through the corresponding part of the spinal cord. If, by means of the Spanish fly, we can excite, though but from time to time, the function of that part, we may obviate, in a great degree, the distressing consequences of incontinence of urine, arising from paralysis of the *sphincter vesicæ*. Dr. Marshall Hall relates a very interesting fact, bearing directly upon this point. A young lady had a tumour within the tenth and eleventh dorsal vertebræ. It gradually, but completely, severed the spinal marrow, and induced perfect paraplegia. The bladder lost its power of retention. But on giving a dose of the tincture of cantharides the power of retaining the urine was always restored *for the time*. That power would cease, and again be restored, on suspending and repeating the medicine.

Dr. Hall remarks that the cantharides obviously acted through the segment of the excito-motory system left below the division of the spinal marrow.

The tincture may be given in half-drachm doses.

The forms of paralysis that have hitherto been noticed are forms of *partial* paralysis. When the palsy is still more limited, although the epithet partial would be equally applicable, the term *local* palsy is more commonly used. There is one of these local palsies which is exceedingly interesting, and of much importance: I mean palsy as it affects exclusively one side of the visage; *facial* palsy. It is sometimes called, not very correctly, paralysis of the portio dura of the seventh nerve. It is, in truth, paralysis of the muscles supplied by that nerve. But the word paralysis is misused when it is intended to express any other loss of function than that of the faculty of motion in muscular parts. It is incorrect to speak, as some authors do, of palsy of the kidney; it is equally inexact to speak of palsy of a nerve.

I say that facial *palsy*, and facial *anæsthesia* (for the two may well be considered together), are very *interesting* affections, because they elucidate, in the human subject, some of the most curious discoveries of modern physiology: and they are *important* affections for you to study and understand, inasmuch as, though always distressful and alarming to the patient and his friends, and sometimes indeed indicative of extreme danger, they often are merely inconvenient and disfiguring, and bespeak no peril at all.

Let us first consider that affection in which the majority of the muscles on one side of the face are alone palsied. I have already briefly touched upon that slight and limited palsy of the face which forms a part of ordinary hemiplegia. But it is of much consequence to attend to it when it occurs without any similar affection of the limbs. If the arm, or leg, or both, are paralysed at the same time with certain muscles on one side of the face, we know that the whole results from disease in the brain. But it is not necessarily so, and it is not often so, when one half of the face is the only part palsied; and it is of great moment to the comfort and the safety of the patient, that we should be able to tell whether the palsy does imply disease within the skull, or not.

The appearance presented by patients affected with facial palsy is peculiar, and very striking. From one half of the countenance all power of expression is gone; the features are blank, still, and unmeaning; the eyelids apart, and motionless. The other half retains its natural cast, except that, in some cases, the angle of the mouth on that side seems drawn a little awry. This is apt to be mistaken for proof of a spasmodic condition of that part; but it is owing simply, as I stated before, to the want of the usual balance or counterpoise from the corresponding muscular fibres of the palsied side. The patient cannot laugh, or weep, or frown, or express any feeling or emotion with one side of his face, while the features of the other may be in full play. One half of the aspect, with its unwinking eye, its fixed and solemn stare, might be that of a dead person; the other half is alive and merry. The incongruity would be ludicrously droll, were it not so pitiable also, and distressing. To the vulgar, who do not comprehend the possible extent of the misfortune, the whimsical appearance of such a patient is always a matter of mirth and laughter. On the other hand, his friends and relations imagine that he has had a stroke, and are in great alarm for his life. In the majority of these cases there is not, however, any real danger of that kind to be apprehended; a circumstance which, of itself, would render the exact diagnosis of the complaint peculiarly interesting: and this exact diagnosis you may at once determine by noticing the condition of the eye. Inability to close the eyelids—paralysis of the orbicularis palpebrarum—is the pathognomonic sign of facial palsy from suspended function of the portio dura: and this muscle is seldom much affected in cases of brain disease.

In general there is no deficiency of sensation. And, *vice versâ*, we sometimes have loss of sensibility in the same parts, without any diminution of the power of motion. The best way, I believe, to place the phenomena of these curious affections plainly before you, will be by examples.

A house-maid, Jane Smith by name, twenty-eight years old, became one of my out-patients at the Middlesex Hospital, with the following symptoms. She had lost all power of moving the right side of her face. When she endeavoured to raise her eyebrows, the right side of her forehead remained smooth, and the left was wrinkled. When she attempted to close her eyes, the right eye was but partially covered, the eye-ball rolling upwards, and carrying the cornea within the curtain of the upper lid, which descended a little to meet it. When she tried to snuff in air through the nose, not being able to keep the right nostril stiff and open, its sides came together, and no air passed up on that side. When she smiled, the right side of the face remained perfectly still, like a mask; and it wore at all times a vacant and inanimate character. When she was told to perform the action of blowing, her right cheek was puffed out like a loose bag, and the breath issued, whether she would or no, at the right angle of her mouth. The same thing happened with her food and drink; she could not prevent their escaping at the right corner of her mouth; nor could she transfer morsels of food from the right to the left jaw, without the aid of her hand applied externally in support of the paralysed cheek. The masseter and temporal muscles, however, acted as strongly on the one side as on the other; she could chew perfectly well on the palsied side, and the sensation of the palsied parts remained perfect; and there was no paralysis of any other part of the body.

All these phenomena are invariably met with in all complete cases of this kind. I will contrast them with the phenomena presented by another of my patients, who was in the hospital, and whose name was Ann Church. I give their names, that I may the more readily distinguish the one from the other. When this woman, Church, applied for admission, she complained of intense pain, with some swelling, in the right temple, and extending thence generally over the right side of the face and head. It was soon discovered, however, that although she complained of most severe pain in these parts, they had entirely lost their ordinary sensibility to external impressions. She felt nothing when her forehead, or cheek, or nose, or chin, or ear, was touched on that side. In short, there was complete *anæsthesia* of the right half of the face; just as in Smith's case there was complete *palsy*. The insensibility was very exactly limited to the right half, and terminated abruptly at the middle line. It was remarkably evident in a part in respect of which the bystanders could scarcely be deceived, even if there had been any reason (which there was not) for distrusting the patient's own statement. The surface of the eyeball is proverbially sensitive, even to slight impressions. But you might place your finger upon this woman's right eye, or you might brush it with a feather, without giving her the smallest pain, or producing any sensation at all: whereas, on the left side, the lightest touch caused involuntary shrinking, and closure of the eyelids, and a gush of tears. She declared also that she had no feeling in the right half of her mouth; she neither tasted sapid substances, nor was she at all conscious, from any sensation produced by them, that they were placed there. Her lips on the same side were equally destitute of sensibility; so that when she drank, having no perception of the contact of the cup with her lips beyond their middle point, she felt as if she were drinking from a vessel with a broken rim. This is a circumstance which all persons who are thus affected are much struck with: and it almost always forms a part of their voluntary account of themselves.

Besides this defect of sensibility, the power of contracting the masseter and temporal muscles on the right side was entirely abolished in this patient. You may deceive yourselves on this point, if you do not investigate it carefully, and with certain precautions. At least I have known persons doubt, because, having directed the patient to open and shut his mouth, they have confounded the movement of the whole jaw with the action of the masseter muscle. But if you tell the patient first to close his mouth, and then to perform the action of grinding with his teeth, placing your fingers at the same time on the corresponding muscles on each side, the difference, when it exists, will be very striking. In the woman of whom I speak, no swelling of the masseter or temporal muscle on the affected side took place when she forcibly closed her jaws. There was no other paralysis.

Now we cannot separate the physiology from the pathology of such affections as these. Nor ought we. The morbid conditions of which the two cases just described furnish samples, illustrate in a very beautiful manner the modern doctrine respecting the special uses of particular nerves. In the first of the two cases the palsy resulted from suppression of the function of the hard portion of the seventh pair of cerebral nerves; and the anæsthesia, in the last of the cases, depended upon suspension of the function of the fifth pair. You know that experiments performed upon living animals have proved that the division, by the scalpel, of the portio dura, before it spreads out into that remarkable nervous network on the side of the face, paralyses all the muscles the combined play of which gives variety and significant expression to the countenance; and that, on the other hand, the division of the fifth nerve deprives the same parts of their sensibility. In these two cases, and in such as these, for they are by no means infrequent, a similar set of experiments upon the same nerves, in the *human* living body, is performed before our eyes by the agency of disease, or accident: and the result justifies most completely those conclusions which had been deduced in the first instance, from contrived observations made upon the lower animals.

There is one point in the history of these cases upon which I must dwell a moment longer; for it is a very interesting point. That the condition of the temporal and masseter muscles should be reversed in two patients so oppositely situated, was no more than might have been expected. But in each these muscles were affected in a manner the very contrary of that which the general circumstances of the case would, *à priori*, have prepared us to anticipate. Where the superficial muscles were paralysed, and the principal movements of the face suspended, there the masseter and temporal muscles were in full power and action; and where the loss of sensation was the predominant phenomenon, and the ordinary motion and expression of the countenance remained, there these muscles were in a state of complete palsy.

A few years only ago, at a time within my own memory, this difference and apparent inconsistency would have been quite inexplicable. The progress of modern science has removed the difficulty, by establishing a general agreement between the *functions* of different nerves, and certain observed peculiarities in their *anatomical relations* and *arrangements.*

You know that the fifth nerve, like the spinal nerves, has two roots, one larger than the other, and furnished with a ganglion; the other smaller, and having no ganglion. It was natural to infer that the functions of these roots would be analogous to those of the corresponding roots of the spinal nerves; that the ganglionic fasciculus would relate to sensation, and the other to motion. And such was found to be the case; the arrangement here is really very curious. The smaller portion of the fifth nerve is exclusively expended upon a very few muscles; viz., the masseter, the temporal, the two pterygoid muscles, the circumflexus palati, and the tensor tympani. The action of the two first of these, of the masseter, and temporal muscles, is obvious to common observation; and therefore their condition is noticed in such cases as I have related. Again, these very same muscles have been shown, by careful dissection, to receive no nervous branches from the seventh nerve, which is a motor nerve, and which ramifies so abundantly upon the superficial muscles of the face.

It was to be expected, therefore, that any diseased state confined to the *portio dura* of the seventh nerve, would leave the temporal and masseter muscles fully effective: and that disease involving the fifth nerve, but leaving the seventh untouched, would destroy, not only the general sensibility of the face on that side, but also the power of contracting these particular muscles. And this was thoroughly exemplified in the two cases that I have detailed. The girl Smith had total palsy of the superficial muscles; but sensation, and the action of the deeper-seated muscles, continued perfect: while in the woman Church there was default of sensibility, and paralysis of the temporal and masseter muscles; but the movements of the superficial muscles were unimpaired.

Total interruption of the function of the portio dura will paralyse these superficial muscles of the face: and such interruption may be occasioned either by *sudden injury* done to the trunk of the nerve; or by *disease* affecting its proper structure; or by *pressure*, the consequence of disease in parts contiguous to it. And it is of great importance to observe that the morbid condition which causes the interruption may be situated at any point in the course of the trunk of the nerve: while it is yet within the cranium; or during its passage through the petrous portion of the temporal bone; or after it emerges upon the face, through the stylo-mastoid foramen, to be ultimately spread in meshes over the cheek and temple. The nerve may be compressed or hurt while still within the skull; but in *most* cases of this kind other portions also of the nervous matter are involved in the mischief, and other sets of voluntary muscles testify this by their immobility or their irregular action. This is the case when partial or imperfect facial palsy occurs as a part of hemiplegia. In ordinary hemiplegia, however, there is but slight distortion of the countenance, a mere hanging of the cheek, with no paralysis of the orbicularis muscle of the eye. The palsy may be *so* slight as to cause no inconvenience to the patient, who may even be unaware of it. The distortion of his features, when he merely smiles, may be so little as to escape the notice of a bystander—but it becomes marked and obvious if he is asked to show his upper teeth. Yet remember—this trifling degree and extent of facial palsy is, in ninety-nine cases out of a hundred, as I have already admonished you, a much more formidable symptom than the total facial palsy with which we are now occupied. Total facial palsy results, in a great majority of instances, from obstruction to the nervous function in that part of the portio dura which lies incased in the bone, or in the more exposed part which issues in front of the ear: and that is why this particular form of palsy is, in general, unattended with any peril to life.

The physical cause of this remarkable disfigurement, and the true explanation of its prevailing immunity from danger, were first pointed out by Sir Charles Bell: but both the existence of the malady as a distinct form of disease, and its comparative harmlessness of character, had been observed and described some years previously: although the reason neither of the one nor of the other was at that time understood. Dr. Powell had narrated, in the fifth volume of the 'Transactions of the College of Physicians,' three marked instances of this form of local palsy; and had noticed at the same time its apparent independence of any apoplectic tendency, or cerebral disease.

The exciting causes of the complaint are various. Sometimes it is the consequence of mechanical violence, by which it is plain that the nerve has been lacerated, or otherwise injured. Sir Charles Bell, to whom we are indebted for much information on the subject, mentions several examples of this kind. In one a man was shot by a pistol ball, which entered the ear and tore the portio dura across at its root. In another, the patient was gored by an ox: the horn of the animal entered beneath the angle of the jaw, and came out in front of the ear, tearing the nerve across. In a third, the nerve was divided by a surgeon's scalpel, in an operation for the removal of a tumour which lay above and around its course. I have myself known the same disaster to result from the unlucky incision of an abscess near the ear. In all these cases the injury was external and obvious. In a fourth, the palsy followed a blow on the ear which caused hæmorrhage from that part: here probably the nerve was hurt in its passage through the bone. Some time ago, a man was brought into the Middlesex Hospital who had fallen from a height, upon his head. The muscles of the left side of the face were paralysed. He died in a few days; and examination of the head showed a fracture in the base of the skull, passing through the petrous portion of the temporal bone, and rending the seventh nerve at its entrance into the meatus auditorius internus. In the year 1832 I had a patient (Richard Hills) in the hospital with the same kind of paralysis, which seemed, in him, to have been occasioned by a mere shock or jar. He was a coachman, and one day, when he was off his box, his horses started away, and he ran to their heads to stop them, but was thrown down in the attempt, striking his hip and elbow. He received no blow on the head at all. Three hours afterwards he found that he could not *spit* properly. The affection is not unfrequently discovered by that circumstance. He could not avoid spitting on his clothes on one side; and he could not whistle.

Another circumstance worthy of notice took place in this man, which often, though not always, happens in these cases, and which I did not mention before. He remained for about two months in the hospital; and regained during that time in some degree the power of exercising the affected muscles; but he still was unable to bring the right eyelids together. The eye itself was unharmed. After he was made an out-patient he resumed his functions on the coach-box; and his eye, permanently half-open and unprotected, was more exposed to dust and to currents of wind than it had been when he was an in-patient. Moreover he got drunk; and he soon presented himself again with universal redness and inflammation of the conjunctiva. Sometimes the inflammation in such cases produces opacity of the cornea and a total loss of vision. This is one of the worst consequences of facial palsy. Fortunately it is only an *occasional* consequence: and it will occur or not, according to the quantity of motion which remains to the eyelids, and the degree of exposure to the ordinary causes of inflammation. I have noticed that—either from differences in the completeness of the palsy, or from peculiarities of the features—the speech is more embarrassed in some of these patients than in others. Labial sounds, and words that require the explosive pressure of the buccinator muscle, are uttered imperfectly; and the patient soon learns to assist his defective articulation, by supporting the palsied cheek with his hand, and so affording a fulcrum to the lips.

Sometimes the palsy depends upon manifest *external disease*; sometimes upon disease which is hidden, and probably *internal*; in the bony canal. Sir Charles Bell describes an instance in which it accompanied the disorder called the mumps. Dr. Malden, of Worcester, witnessed another in which a fixed, hard, indolent, tumour, had formed between the ramus of the lower jaw and the mastoid process of the temporal bone. As this tumour gradually subsided, the palsy disappeared. In each of Dr. Powell's three cases the affection was apparently caused by exposure of the side of the head for some time to a stream of cold air. A medical acquaintance of mine residing in London, had a patient at Greenwich, whom he visited daily. It was cold weather; and on one occasion, as he was returning in the cabin of a steam-boat, he was sensibly incommoded by a keen east wind, which blew through an open window directly upon his ear. The next day he presented himself to me with that side of his face fixed in the manner I have been describing.

Exactly the same mishap befell a Scottish physician while travelling to London by a coach: and sent him in great alarm to Sir Charles Bell. Some years ago a marked example of facial palsy occurred in one of my hospital patients; it appeared to be owing to his having been constantly in the streets for some days without shoes or stockings, during a cold thaw. It may be presumed that in these instances some swelling was produced in the soft parts around the nerve, compressing it where it lies within the unyielding bone. Exposure to cold in this way is the commonest of all the exciting causes of the complaint, and cases thus arising are more obedient to treatment than most others. Probably some of you saw a female patient who came under my care in the hospital in May last (1838), in whom facial palsy had existed on one side for eighteen years. When about three years old she had the measles; and a scrofulous tumour formed behind the ear, and broke: and after some time, a portion of carious bone came away. Then the wound healed (of which deep traces are still visible); and the peculiarity of her features was observed. There are still other cases in which we fail to discover any direct explanation of the paralysis, either in the history of the patient, or in his physical condition. In the girl Smith, whose symptoms I stated in detail as an example of the appearances uniformly present, the malady came on without any obvious cause, and it resisted all the means employed for its removal.

That a very large majority of cases of this kind are free from serious peril, is a fact of great practical importance. It enables us to quiet the alarm of the patient and of his family: and it regulates in many instances the *treatment*; rendering it less active than it might and perhaps ought to be, if the palsy were really the harbinger of apoplexy. At the same time you should not be ignorant that a similar limitation of paralysis to the particular muscles supplied by the portio dura is sometimes (though rarely) observed, when the disease has a more inward origin; when it affects and involves the brain itself. The following case caused me much anxiety, for the subject of it was a personal friend of mine.—I was summoned to his house in the autumn of 1829, and found him with complete palsy of the left side of the face. It had existed a day or two. I shall not describe the appearances and symptoms that resulted from the paralysis: for they were precisely the same as were presented by the girl Smith; and they are always, and necessarily, very much alike. But though the *palsy* was strictly limited to this set of muscles, there were other symptoms present which indicated that the interruption of the functions of the portio dura was connected with some morbid condition within the cranium: nausea and vomiting, twitching of the muscles of the *other* side of the face, great drowsiness, and a slow pulse, 48 only in the minute. He lurched also, and staggered as he walked; but he distinguished this from the reeling of vertigo, and denied the latter sensation altogether. He was deaf, too, on the affected side.

His previous history did not tend to diminish the fears which his actual state excited.

In the preceding February, he had been attacked, rather suddenly, with intense pain just above the right eyebrow, and became extremely drowsy. Being desirous, on account of these feelings, to excuse himself from a dinner engagement, he found that he was unable to write a proper note: he could not remember how he ought to express himself.

All these symptoms soon passed off; after the operation, I believe, of an emetic. But he had another attack of the same kind in the subsequent May: the same severe pain over the right brow, with great drowsiness and confusion of mind. He could not recollect the first line of the Æneid. He wished a friend to look at the *signatures* of some letters that had arrived: and though he knew the root, he could not tell how the word he wished to use was formed: whether it was signition, or signation, or signature. The digestive organs on this occasion were made the object of treatment, and he soon got well.

Another part of his history was instructive; and therefore I mention it. Before these attacks he had been in the habit of eating and drinking freely: and his power of digestion was supposed to be enormous. After the attack in May he commenced a strict course of temperance. He drank no wine *till three or four days before* the occurrence of the facial palsy: he had then taken it again; about four glasses daily: and on one of the days he drank two glasses of champagne.

It was of some moment to this gentleman, not only that he should recover, but that he should recover quickly. He had been appointed by Government to a mission in Ceylon, and all his equipment was already on board a vessel which would sail in a fortnight.

Cupping behind the ears, blistering, purgatives, and small doses of calomel continued till the gums were slightly sore, removed the paralysis, and all the other symptoms, in about ten days. He went to Ceylon, and accomplished his mission so ably that after his return the Government appointed him to one of far greater importance in India. He has remained perfectly well; and possesses one of the clearest and strongest intellects that I am acquainted with.

I must trouble you with one more case, to complete the history of this disease: a case in which the cause of the facial palsy was situated within the cranium and proved fatal, and became visible after death.

Samuel Dovey, a tailor, fifty-seven years old, was admitted under my care into the hospital, in February, 1833, with complete palsy of the muscles supplied by the portio dura on the right side, and of no others. There were symptoms enough, however, to show that some serious mischief was going on within the skull. He suffered intense headache, more on the left than the right side; was dizzy and staggering; and could not get to the ward without being led.

The palsy had come on about ten days before, in the night. He found when he came down stairs the next morning that he could not spit as usual; and his friends observed the unnatural state of his features. He had had no fit, nor loss of consciousness; but he thought his memory was failing. At the time when the paralysis was first noticed, he had some numbness and tingling of the right arm, extending to the last two fingers. He was quite deaf in the right ear. This is a point deserving attention in such cases. The deafness, when it occurs, marks an affection of *both the portions* of the seventh nerve: and therefore indicates the probability of an *internal* cause.

The whole progress of this case was very interesting; but I must confine myself to those circumstances which bear upon our present topic. He lived about a month after his admission, and during that interval he suffered great pain in the head, was delirious at times, and at other times in a state of coma: at one period he suddenly presented the ordinary symptoms of apoplexy, from which he partly recovered.

I found a cancerous tumour occupying the right hemisphere of the brain; and at its under part was an apoplectic clot, as big as a hazel nut. I found also a very satisfactory explanation of the deafness and of the facial palsy which had been noticed during his lifetime. The portio dura and the portio mollis, where they emerge as distinct cords from the medulla oblongata on the right side, were adherent to each other. The portio dura was both harder and larger than the corresponding nerve on the opposite side, while the portio mollis was wasted and diffluent. The same change was traced up to their entrance into the petrous portion of the temporal bone. Immediately over the medulla oblongata, and in a vertical line above the point of emergence of the seventh pair of nerves, a nipple-like portion of brain projected downwards, and had apparently communicated pressure to these nerves; and this projection from the lower surface of the brain seemed to have been produced by the general pressure resulting from the growth of the tumour.

The remarks which I have been applying to *palsy* of these parts hold true also in respect of their *loss of sensibility*. The anæsthesia may or may not portend danger to life, according as the interruption of nervous function on which it depends is situated more or less near to the origin of the fifth pair of nerves in the brain. The patient, Church, whose case I have several times referred to in this lecture, left the hospital with the sensibility of her face nearly as perfect as ever. The treatment consisted in local blood-letting and counter-irritation. She had erysipelas of the head while in the hospital, and was in some danger from that complaint, which was attended with a good deal of fever and delirium. With the exception of the delirium, which belonged no doubt to the erysipelas, there was no reason to suspect any affection of the brain.

I have incidentally adverted to the plan of treatment to be pursued in these cases of facial palsy. When the complaint is recent, and has an obvious cause, the appropriate remedies will readily suggest themselves. When, for example, it has come on after exposure to a current of cold air, or after a blow, or any circumstance likely to give rise to inflammation, you must treat the case as you would treat inflammation; bearing always in mind that a small amount of disorganisation, a little thickening or induration of the parts around the nerve, may render the deformity and the inconvenience *permanent*. Take a moderate quantity of blood from the neighbourhood of the affected nerve by cupping or by leeches: apply fomentations; or, what is better in these case, conduct the steam of hot water against and into the ear. I would also give the iodide of potassium, with the view of obviating, possibly, any abiding pressure upon the nerve by effused lymph.

Where there is any ground to suspect that the brain is implicated, the treatment just described must be pursued with greater diligence, and with such modifications as the nature of the case may require. If there be evidence of chronic disease in the petrous portion of the temporal bone, such as tenderness of the mastoid process, deafness, a protracted discharge from the ear, and an imperfect state of the membrana tympani, we can scarcely expect much good from very active treatment. We must then have recourse to counter-irritation, and such other measures as I spoke of when the subject of otitis was briefly considered.

The examples which are met with of local palsy, and local anæsthesia, are numberless; but those which I have mentioned are the most common and the most important. They are always deserving of attention; but more so when any suspicion arises that they may be connected with cerebral disease. Sometimes they evidently have no such connection. In the month of November, 1834, a coachman became my patient in the hospital with incomplete paralysis affecting some of the muscles of the right leg alone, with numbness of the foot. He could both stand and walk; but on advancing that leg, his foot flapped suddenly down, and he could not deliberately direct and plant it like the other. His general health was quite good; he had no headache, nor giddiness, nor palsy of any other part. But a month previously he had been sitting with the right leg thrown over the opposite knee; and he continued in that position until the foot felt numb, and tingling, and was (what is called) asleep; and it had remained in the same condition from that time. After some general treatment (cupping and purgatives) before he came to the hospital—treatment which was quite proper in the way of precaution, but which was probably, in truth, unnecessary—I had his leg electrified; and in about ten days the sensation and the power of the limb were almost restored. Mr. Swan mentions a somewhat similar case, in which anæsthesia of the hand was produced by strong pressure made upon the wrist.

There are some very curious facts connected with anæsthesia, showing that the voluntary exercise of the muscles is regulated in some measure by the sensations of the limb that is employed. The sense of resistance prompts to such contraction of the muscles as is required to balance that resistance; reminding the will (so to speak) of the necessity that exists for its perpetual and vigilant operation. I have alluded to this before in speaking of paraplegia. Continued volition is essential in these cases to the continuance of the muscular tension. Thus Dr. Yelloly describes a woman who had no power of feeling in her hand and fingers, although the power of moving them, and of grasping substances, was perfect. This woman found that she could carry glasses or plates in that hand very well and safely, if she continued to look at and attend to them ; but if her eyes were turned another way, as she did not feel what she held, she was very apt to drop it. Dr. Ley met with just such another case. A woman had defective sensibility on one side of the body : she could hold her child in the arm of that side so long as her attention was directed to it ; but if surrounding objects diverted her from taking notice of the state of her arm, the flexor muscles soon began to slacken, and the child was in danger of falling. All this is extremely curious.

Andral has recorded a most singular example of local anæsthesia, which preceded an attack of apoplexy. The patient lost, from time to time, all sensation in certain isolated parts of the skin upon the thorax : there were five or six of these insensible spots, each about the size of a five-franc piece. You might pinch the skin in these places without producing the slightest feeling in the patient. In all other parts the sensibility was perfect and lively.

A well-known London physician, about eighty years old, sent for me one day to tell me that, without any other symptom of illness, he had suddenly lost all feeling throughout the whole of the right side of his body. The power of movement remained unimpaired. He naturally enough thought that his hour was come ; that this remarkable symptom was the prelude of approaching death, about which, however, he expressed no alarm. But in two or three days the anæsthesia had passed harmlessly away ; and he lived a year or two afterwards. I have since heard of one other instance of this inexplicable state of the nervous system.

There are other cases also on record, more remarkable still ; in which the patients have lost both the power of motion and the faculty of sensation in almost every part of the body, and yet have survived for a considerable time. Thus one person (whose case is related in the 'Bulletin des Sciences Médicales' for January, 1828,) became first amaurotic, then deaf, and then by degrees lost all power of sensation and motion except in the tongue and in the muscles of deglutition and respiration. His speech and intellects were unimpaired. It was accidentally discovered that a small patch on the right cheek retained its sensibility ; and by tracing letters on this sensible spot, his wife and children were enabled to interchange ideas with him. He died at length, and his body was not examined.

I shall finish what I have to say on this head, by relating a case of the same kind, which occurred under Dr. Abercrombie's notice; and which we are sure, therefore, would be observed with care, and recorded with fidelity.

A servant girl, about twenty years old, sprained her back in lifting some heavy article of furniture. She felt no great inconvenience at the time: but some little while after, weakness of the legs came on, and gradually increased to complete paraplegia. After an interval, the affection extended to her arms, and she then had not a fragment of motion of any of the parts below the head, except a very slight movement of one of the fingers: but the internal functions were all perfect, and her utterance was distinct, except that in speaking she was sometimes seized with spasmodic twitches of the lips and lower jaw. She lived in that state, without any change of the symptoms, and her general health continuing good, for about twenty years. In the morning she was taken out of bed, and placed in a chair, so contrived as to support her in a sitting posture. Her arms rested on a cross board which lay before her; and if by any accident one of them slipped from this support, she had no resource but to call for the assistance of another person to replace it. Having been on one occasion left alone for about two hours after one of her arms had thus slipped down, the hand had become extensively œdematous. In the same manner, if her head fell forward upon her thorax, it remained in that position until raised by an attendant. Her mind was entire. She died after four days' illness with symptoms of low typhus fever. You may suppose that Dr. Abercrombie looked with the greatest interest for the cause of these most remarkable symptoms. 'I examined the body with the utmost care, (says he,) along with Dr. Pitcairn, who had been in the habit of seeing her for several years; and we could not discover any disease either in the brain or in the spinal cord.'

It is much to be regretted that when this case was under observation, the excito-motory functions were not understood, nor attended to.

I shall next proceed to consider those diseases (and there are several of them) which are marked by definite symptoms, which consist essentially in some disturbance or disorder of the nervous system, but which are not accounted for by any physical changes that we can appreciate in any part of that system. After some of these diseases we do, to be sure, sometimes meet with morbid appearances in the nervous centres: but none that are constant, or uniform.

LECTURE XXVII.

Tetanus. Its Symptoms and Varieties. Causes. Diagnosis. Pathology. Treatment: Opium; Blood-letting; the Warm Bath; the Cold Bath.

In those diseases of the nervous system which have hitherto engaged our attention, the function of voluntary motion, when it has been affected at all, has mostly suffered in the way of diminution, or suspension; the power of moving has been lost, or impaired; there has been complete or incomplete *palsy*. Sometimes, indeed, convulsion, or an irregular and involuntary action of the muscles, has also occurred. But, distinct from the paralytic affections, there is a class of *spasmodic* diseases, of which it is the main and leading feature, that the function of voluntary motion is (not morbidly heightened, as in the preternatural strength of a madman; nor lowered, as in palsy; but) *perverted*: performed in an irregular and unnatural manner.

There are two sorts of spasm. One of these is marked by a long-continued contraction of the affected muscles, not rapidly alternating with relaxation: the relaxation taking place slowly, after some time: and then, perhaps, the contraction, after another interval, coming on again. This is called *tonic* spasm; and, by Cullen, spastic rigidity. A very familiar example of it is the common cramp of the leg. In the other form of spasm, the contractions of the affected muscles take place repeatedly, forcibly, and in quick succession; and the relaxation is, of course, as sudden and frequent. This has been named *clonic* spasm. We find illustrations of it in convulsions.

Sometimes the two are mixed together in the same disease; certain muscles undergoing convulsions or clonic spasm, and certain other muscles, or the same in their turn, being affected with rigidity or tonic spasm. But it is convenient to keep the distinction in mind.

We recognise these disorders by the unnatural conditions of the *muscles*: but you will please to remember that the fault lies in the *nervous* system.

With regard to spasmodic and convulsive diseases generally, I may say that some of them constitute the most appalling and fatal maladies to which the human body is liable; and some of them, though frightful to look upon, and productive of extreme distress to patients and to their friends, are trivial in their consequences, and scarcely ever attended with any peril to life.

I propose first of all to consider one of the most formidable and worst of these spasmodic diseases, viz., *tetanus*: of which tonic spasm is essentially characteristic. Its name is derived from τείνω, to stretch.

With all those diseases concerning the exact or full pathology of which we are ignorant, and which we identify by the group of symptoms they present, rather than by any organic changes of structure in any part of the body, the most convenient mode of proceeding will be, first to describe the distinctive symptoms.

Tetanus, then, is characterised by an involuntary, long-continued, violent, and painful contraction—in one word, by *cramp*—of the voluntary muscles of various parts, or of nearly the whole body.

There is no difficulty in recognising the disease when it is fully formed. But it is of much importance to be aware of the marks of its approach, and of its earliest symptoms; in reference to the treatment to be then adopted.

The muscles that seem, in general, to be the earliest affected are those of the neck, jaws, and throat. The patient feels a difficulty and uneasiness in bending or turning his head; and supposes that he has got what is called a stiff neck. He finds also that he is unable to open his mouth with the customary ease. At length the jaws close: sometimes gradually, but with great firmness; sometimes (it is said) suddenly, and with a snap. In four cases, perhaps, out of five, the disease begins in this way, with *trismus*, or *locked jaw*: so that this last is the vulgar name for the complaint. Along with this symptom, or very soon after it, the muscles concerned in swallowing become affected; and in a short time there comes on, what is often the most distressing part of the disorder, an acute pain at the lower part of the sternum, piercing through to the back. This depends, it can scarcely be doubted, upon cramp of the diaphragm. The pain is subject to aggravation in paroxysms; and each paroxysm of pain is attended with increased contraction of the other parts also that are implicated. The spasm extends to the muscles of the *trunk*: to the *large* muscles of the *limbs*; which it extends and widely separates: the muscles of the *face*: and last of all, in general, to the muscles of the tongue, and of the hands and fingers, which often remain moveable at the will of the patient, after all the other voluntary muscles of the body have become fixed; and frequently the muscles of the wrists and hands escape altogether.

With respect to *all* the muscles involved, from the time when they are first affected to the time when the disease is relieved, or the patient dies, they *continue* in a state of contraction, and are swelled and hard in their centres. The jaw, for instance, can never be completely opened, and the muscles of the abdomen are so rigid as to make it hard, like a board. But, besides this, they are all subject to aggravations or exacerbations of the spasm, which occur perhaps every ten minutes, or quarter of an hour, and last for two or three minutes at a time; and then the muscles fall back into the minor degree of contraction in which they were prior to the exacerbation. In a very few instances only has a perfect remission of the spasm been observed. The exacerbations usually begin by an increase of the pain felt at the sternum. Sometimes there is no obvious exciting cause of their occurrence; but frequently it is evident that they are brought on by exertions of the body; even by slight movements, such as belong to a change of posture, to the attempt at swallowing or speaking. As the disease advances, these paroxysms of aggravation become more frequent, and a rapid increase in the frequency of their recurrence is one of the most unequivocal signs that the case is severe and dangerous. The more speedily the intervals between the paroxysms shorten, the worse.

It is a curious thing, that the spasm is observed to give way, sometimes at least, and the muscles to be relaxed, during sleep. To be sure, in the severer cases, the patient is seldom able to sleep; and it may be that in the less violent instances, the spasm abates or ceases, and the exhausted sufferer sinks into repose in consequence of this abatement. However, a similar phenomenon occurs in at least another of these spasmodic diseases, as we shall see hereafter. Mr. Mayo had a boy afflicted with tetanus, in the Middlesex Hospital. On visiting him one day, he found him asleep, and remarked that he lay perfectly relaxed. The abdominal muscles were soft and yielding, and had not the slightest tension. The boy was awakened, and at the instant the full tension of the muscles returned. Not being further disturbed, he fell asleep again in a few minutes, when the muscles again slackened; and again, upon his being a second time roused, resumed the state of spasm.

In most cases the strong muscles of the back are the *most* affected, and they overcome those on the fore part of the body; so that sometimes the patient during the paroxysm rests only upon his head and his heels, while his body is raised into the shape of an arch. This form of the complaint is called *opisthotonos*, a bending backwards. It is a common form. The sterno-mastoid muscles of the neck have been so stretched and misplaced as to become powerful *extensors* of the head. In a few instances the body is bent forwards, so that the head and knees are in contact, and the patient is rolled together like a ball. This is called *emprosthotonos.* This is uncommon. In the only example of emprosthotonos which I ever saw, these two conditions alternated with one another. The patient was a girl, in Edinburgh, under the care of a friend of mine, who took me to see her. It was a case of hysteria rather than of tetanus; but all at once she would be drawn into a position such, that the top of her head, and her feet, were alone supported on the bed, while her body was bent backwards, like a bow; then, after a time, with equal suddenness, the opposite posture was assumed, her forehead and knees being brought together. Still more rarely the body is bent to one side. This is *pleurosthotonos*, or *tetanus lateralis*; and this I never saw. Sometimes again, in the height of the spasm, the antagonist muscles counteract each other exactly; and the head and trunk are rigidly extended: and the term *tetanus* is by some writers confined to this form of the disease. It is called *trismus* when the jaw only is affected.

It is well to know that these varieties occur, and may be looked for; but in all of them—trismus, opisthotonos, emprosthotonos, or pleurosthotonos—it is the same disease; and the prognosis is not altered any more than the diagnosis, by the variety that happens.

During the fits of exacerbation, the aspect of the sufferer is often frightful. The forehead is corrugated and the brow knit, the orbicularis muscle of the eye rigid, the eyeball motionless and staring, the nostril spread, the corners of the mouth are drawn back, the set teeth exposed, and all the features fixed in a ghastly grin—the true *risus sardonicus.* The tongue is apt to get between the teeth, and to be severely bitten.

All the contractions are attended with intense pain. You may form some notion of the severity of this pain, if you have ever been troubled by spasm of the gastrocnemius, or cramp of the leg, and if you can bring your mind to conceive that the same sensation which you then felt in the calf, involves nearly all the voluntary muscles of the body. The pain is worst during the exacerbations, and that which is experienced at the sternum is commonly the most complained of. Even to this, however, there are occasional, though very rare, exceptions. Sir Gilbert Blane has described a case of tetanus, which ran the usual course, and terminated fatally, yet the patient suffered no pain: the sensation excited by the violent muscular contractions was a sort of tingling, of rather a pleasurable kind.

So *violent* are the contractions sometimes, that the teeth have been broken by them. There is one case related in which the thigh bones were fractured by the forcible action of the femoral muscles; and another in which the psoas muscles were found, after death, to have been torn across. Dr. Latham tells me that he once saw one of the recti muscles, in front of the abdomen, thus rent asunder.

With all this disturbance of the muscular system, there is commonly very little derangement of the other functions of the body. The disorder is almost always attended with obstinate costiveness; partly, perhaps, from the spasmodic closure of the anus, partly, perhaps, in some cases, from the medicines that are given. When stools are obtained, they are usually very offensive and unnatural. There is no fever. Yet during the violence of the exacerbations, the temperature of the body—whether from the pain and anxiety then experienced, or more probably as a physical consequence of the muscular contractions—rises to an extraordinary height, reaching sometimes 110° F. This fact is stated by Wunderlich: but it was noticed long ago by Dr. Fribo, of Geneva. At the same time a profuse sweat breaks out, which disappears during the intervals between the paroxysms. In the last stages of the fatal cases, the pulse becomes quick and feeble, and the sweat is cold, as in other instances of approaching dissolution.

What is still more worthy of observation is that the mental functions are unaffected. There is seldom any coma or delirium, or other disturbance of the intellect. These symptoms appear (if they appear at all) only when other indications of the failure of the powers of life come on.

The mode of death in this disease seems to be of a mixed nature. Partly it appears to result from apnœa; the thorax being held as in a vice by the spasm of the muscles, and the breathing for a time suspended, or much embarrassed: partly, and chiefly, it occurs from asthenia; the power of the heart flags and is exhausted by the continuance of the suffering, by the fatigue and expenditure consequent upon the muscular action, and by the patient's inability, in many cases, to take sufficient nourishment. When death happens suddenly, as it sometimes does, in a paroxysm, it is owing, in all probability, to spasm of the respiratory muscles, and perhaps of those of the glottis among the rest.

Most cases of tetanus may be traced to one of two causes: which are, *exposure to cold and wet*, especially to sudden alternations of temperature, and *bodily injuries*. In many instances both these causes co-operate in producing the disease. When it supervenes upon some bodily hurt, it is called *traumatic* tetanus: when it arises spontaneously, or after exposure to cold, it is held to be *idiopathic*. In this country, and I believe in every other, the traumatic variety of the disease is much more common than the spontaneous. But in what manner soever it may originate, tetanus is far more frequent in hot than in temperate climates. In this case, however, as in so many others, the heat appears to act as a *predisposing* cause only; the exciting cause, in addition to the wound in the traumatic species, being the application of cold (particularly, according to Hennen, of *cold air in motion*) after the heat, or during the prevalence of hot weather. Thus it is stated that after the battle of Muskau, in the midst of great heats, very few of the French troops were affected with tetanus; whereas those who were wounded in the battle of Dresden, when the weather was cold and wet, just after a very hot season, were decimated by that complaint; which did not spare even those who underwent immediate amputation.

Idiopathic tetanus is extremely rare in this country. Dr. Gregory, of Edinburgh, used to mention in his lectures the case, seen and treated by himself, of a man who, having fallen asleep in moist grass, awoke with a stiff neck, which afterwards went on into regular tetanus. A good example of well-marked tetanus, arising from exposure to cold, is narrated in the 'Edinburgh Medical and Surgical Journal,' by Dr. Hall, of Berwick.

The history of that species of tetanus which occurs in connection with wounds and injuries, presents nothing constant or uniform. The disease is liable to follow hurts of any parts of the body, and of every kind, degree, and extent; from a slight cut or scratch, to a compound fracture, or a severe surgical operation. It comes on also in various stages and conditions of the injury. Sir James M'Grigor tells us (in the sixth volume of the 'Medico-Chirurgical Transactions') that in the Peninsular war the complaint supervened 'in every description, and in every stage of wounds, from the slightest to the most formidable; the healthy and the sloughing; the incised and the lacerated; the most simple and the most complicated.' Sometimes, however, the discharge from the wound has been observed to be remarkably diminished, or suppressed, at the coming on of the tetanic symptoms; and sometimes the wound has healed completely before the commencement of the attack of tetanus. To show you how very trivial the injury may be, how various in kind and in place, I may mention a few instances that have been collected, in illustration of the manner in which this terrible disorder may originate. It has been known to arise from the sticking of a fish-bone in the fauces; from a slight wound of the ear by a musket-shot; from the mere stroke of a whip-lash under the eye, although the skin was not broken; from cutting a corn; from a bite on the finger by a tame sparrow; from the blow of a stick on the neck and on the hand; from the insertion of a seton; from the extraction of a tooth; from the injection of a hydrocele; from tying the small pedicle of a tumour in the neck; from the operation of cupping.

Nevertheless there are some sorts of injury, and some parts of the body, more frequently than others concerned in the pathogeny of tetanus. The disorder more often supervenes upon injuries of the extremities, than of the trunk, head or neck; and upon wounds made by puncture than upon most other hurts. Penetrating wounds in the sole of the foot, such as are not seldom inflicted by treading upon a nail, or a splinter; and laceration, or other violence done to the muscles that constitute the ball of the thumb, are very apt to be followed by tetanic spasm. Injuries of this kind generally involve more or less of bruising, and so of a tendency to sloughing. Some have supposed that the disease has some special connection with injuries of tendinous parts; but there can be no doubt that it is essentially a malady of the nervous tissue.

The tetanic symptoms occur at no fixed period after the reception of the injury. Professor Robinson, of Edinburgh, was once at table, when a negro servant lacerated his thumb by the fracture of a china dish. He was seized with convulsions almost instantly, and died with tetanic symptoms in a quarter of an hour. Such rapid progress as this, however, is quite out of the usual course of the disease: probably fright had something to do with it. Hennen, in his work on 'Military Surgery,' states that terror is frequently the immediate antecedent of the attack. In general the tetanus supervenes between the fourth and the fourteenth day after the infliction of the injury: some time in the second week is the most common period of all. In the Peninsular war it did not commence later than the twenty-second day. In some rare instances, its accession is still longer deferred. 'Of the nature of the changes that take place in the interval (justly remarks Dr. Alison) we have no information whatever.' The longer however, that the disease delays its assault in these traumatic cases, after the reception of the local injury, the milder, in general, does it prove, and the more room is there for hoping that it will end favourably.

When the disorder arises from exposure to cold and damp, it comes on much earlier; often in a few hours. If, for example, the exposure take place during the night, the complaint may begin to declare itself the next morning.

Although tetanus may be excited by a wound, independently of any exposure to cold, or by cold without any bodily injury, there is good reason for thinking that, in many instances, either of these causes alone would fail to produce it, while both together call it forth.

After the disease has set in, its rate of progress is various. Almost all writers divide it into acute, and chronic tetanus. But the difference is merely in the degree of severity. When the spasms come on suddenly, recur often from the beginning, and increase in frequency and violence, the chance of recovery is but small. The patient, in these cases, sometimes dies on the second, and generally before the fifth day. If he live to the ninth day of the disease, his prospect is somewhat better, and the spasmodic symptoms may gradually abate and disappear. Some, however, have died as late as the sixteenth, the twentieth, and even the thirty-fifth day: but this last is very rare.

The idiopathic tetanus, or that which is produced by cold, although it commences earlier, is more generally of a chronic character than the traumatic: that is to say, the spasmodic contractions take place more slowly, and the paroxysms do not increase in violence, and in rapidity of recurrence, as they are apt to do in the symptomatic variety: and accordingly this form of the malady is much oftener, I dare not say cured, but recovered from, than the other.

With respect to the diagnosis of tetanus, there is only one point in which it is at all ambiguous or important. There is no other *disease* that is likely to be confounded with it, except perhaps that extraordinary disease, hysteria, which sometimes mimics its phenomena. I have already alluded to one example of this kind that I myself saw. But there is a form of *poisoning* that may easily be mistaken for tetanus. The symptoms produced by a poisonous dose of strychnia, or its salts, or the vegetables from which it is procured, are the symptoms of tetanus. And as this drug is now readily obtained, and its noxious qualities are well known, it is not unlikely to be made an instrument of suicide, or of murder. It is necessary, therefore, that you should be acquainted with the effects of this poison, which constitutes the active principle of the nux vomica, the faba S^ti^ Ignatii, and the upas tieuté. Dr. Christison has excellently well described these effects as they are observable in brutes; and I have once, by accident, had an opportunity of witnessing them in the human body. I shall not be wandering from our present subject if I enumerate the symptoms to be expected from a large dose of strychnia; especially as I have lately been advising you to make trial of it as a remedy in certain forms of disease. Dr. Christison, who had made experiments with it upon animals, tells us that the creature 'becomes agitated, and trembles, and is then seized with stiffness and starting of the limbs. These symptoms increase, until at length it is attacked with a fit of general spasm, in which the head is bent back, and the spine stiffened, the limbs extended and rigid, and the respiration checked by the fixing of the chest. The fit is then succeeded by an interval of calm, during which the senses are quite entire, or unnaturally acute. But another paroxysm soon sets in, and then another and another, till at length a fit takes place more violent than any before it, and the animal perishes suffocated.'

Some time ago I had occasion to prescribe strychnia for two patients in the Middlesex Hospital, both of whom had paraplegia. I directed one grain to be intimately mixed with crumb of bread, so that it might be divided into twelve pills: and one of these pills, or one-twelfth of a grain of strychnia, was to be taken by each patient every six hours. Unluckily, through mistake or negligence of the person who was at that time the dispenser, a grain of the poison was administered at once, to each patient. It was given about seven in the evening. At half-past seven it began to produce its characteristic effect upon one of the patients. He was suddenly seized with tetanic spasms; his legs were separated widely from each other, and rigidly extended: and his head and trunk bent backwards. He was, in fact, in a state of opisthotonos. His abdomen was quite hard, and his limbs were stiff, even when the violence of the paroxysms abated. He cried out with the pain at the coming on of these spasms. Any attempt at movement, even the touching him by another person, brought them on. This is just what happens in the *disease.* The opening of a door, a sudden current of air, a shake of the floor, or bed, the smallest bodily effort, the act of swallowing, nay, even the imagination of these influences, may be sufficient to renew the spasmodic tightening of the affected muscles. My patient spoke of a particular sense of constriction all over the abdomen, as if it were drawn in. His intellect was quite unaffected. He had two extremely violent attacks of the kind I have been describing, in which he thought he should have died: and to say the truth I was myself horribly afraid of the same catastrophe. Afterwards, from half-past eight o'clock to between eleven and twelve, he had several slighter and shorter fits. He was left weak and exhausted by them: but he soon recovered. I may as well tell you that his paraplegia was not a whit benefitted by this violent action of the remedy.

You may suppose that when I found one of my patients in this alarming state, I became very anxious to ascertain the condition of the other, who had taken the same quantity of the strychnia, and lay in another ward. He told me that he had been for a short period very dizzy, and had trembled all over; and at the time when I saw him, he had a weight or uneasy sensation at the nape of his neck, which drew his head backwards; and he experienced some difficulty in opening his mouth, and in articulating his words. But he thought these symptoms were diminishing rather than increasing. He was perspiring profusely. It is stated by Dr. Christison that if the spasms do not come on within two hours after the poison was swallowed, the patient is safe. It was more than two hours since this patient had taken the strychnia. I gave him a full dose of purgative medicine, which acted as an emetic: and, after he had vomited, the unpleasant sensations about his head and neck left him.

I scarcely knew what to do with the other patient, in whom the spasms had commenced. There is nothing satisfactorily made out, that I know of, concerning the mode of treating such cases. Of course, if one saw the patient early, and knew what he had swallowed, the first thing to be done would be to procure its expulsion from the stomach. But here it had had full time to get into the circulation: and no emetic could have withdrawn that part of it at least, which had already found its way into the blood-vessels. When I reached him, though the spasms were strong, they were less violent than they had been, and their violence seemed upon the wane: but they were brought on by any, almost the slightest, muscular effort, or change of position. I hoped therefore that the most dangerous period was passing off (and so it turned out), and I was fearful of doing harm by exciting those movements of the body which accompany the act of vomiting. I recollected, too, that another patient in the hospital, under the care of one of my colleagues, had once been attacked with opisthotonos after taking half a grain of strychnia; and that brandy and water had been given to him; and that he got well from that time, without having another paroxysm. So I gave my patient some brandy and water; and he seemed the better for it: but whether or no it contributed much to his recovery I cannot be sure.

Now how are we to tell, when we meet with such symptoms as these, whether they are the result of disease, or of poisoning? The symptoms are the symptoms of tetanus; I know of no test whereby to distinguish them from the symptoms of tetanus caused by exposure to cold, or supervening upon a wound, except the period of time over which they are spread. Dr. Christison states that 'the disease never proves so quickly fatal as the rapid cases of poisoning with nux vomica.' 'Besides, the fits of natural tetanus are almost always slow in being formed, while nux vomica brings on perfect fits in an hour or less.' If indeed the case related by Professor Robinson, in which the negro was dead in fifteen minutes, could be relied on as having been a genuine instance of tetanus, this distinction, drawn from the rapidity with which the poison kills, would scarcely hold. But that case is unique, and of such doubtful value that it need not disturb our estimate. Again, persons who have taken an over-dose of strychnia sometimes survive the tetanic symptoms, but die afterwards from the irritant effects of the poison upon the mucous membrane of the alimentary canal. This we do not observe in the disease. 'It is right to remember, however (adds Dr. Christison), that nux vomica (or its poisonous element, strychnine), may be given in small doses, frequently repeated and gradually increased, so as to imitate exactly the phenomena of tetanus from natural causes.' In suspicious or questionable cases, we must look into the history of the patient; enquire whether he were likely to destroy himself, or to be murdered by others; what he last swallowed, and when it was taken; whether he have lately been exposed to the injurious influence of cold, especially to a stream of cold air while he was perspiring; and whether he have recently received any bodily hurt. By a careful investigation of all the circumstances, we shall generally be enabled to decide the true nature of the case; but it is clearly necessary that our eyes should be open to the possibility of a case of poisoning, by some of the preparations of strychnia, being palmed upon us for a case of natural disease.*

The *pathology* of tetanus is undoubtedly obscure: but not more so, I conceive, than that of those nervous diseases in general which produce violent symptoms, and even death itself, without leaving any traces of their operation inscribed upon the dead materials of the body. Nay, it is not *so* obscure as several others. I think we may fairly come to the conclusion that the symptoms result from some peculiar condition of the *spinal cord*, produced and kept up by irritation of its substance, or of its afferent nerves; and that the *brain* is not involved in the disease. The French (at least some of the most modern writers on tetanus) hold that it is always an inflammatory complaint; and that it consists essentially in inflammation of the spinal marrow: and some of them have sought to remedy it by enormous blood-lettings; from fourteen to fifteen pounds of blood being taken in the course of a few days by one practitioner; and another bleeding his patient eight times, and applying 792 leeches along the course of the spine, and to the epigastrium. But this doctrine of inflammation being at the bottom of every case of tetanus is contradicted by the plainest facts; and the practice founded upon it has been pushed to a most extravagant and absurd extent. Numberless instances occur of inflammation of the spinal cord and its membranes without any tetanus; and equally numerous examples of tetanus have been met with, when no unnatural appearance at all could be discovered within the vertebral canal. I say we must content ourselves with referring the phenomena of the disease to *irritation*, direct or indirect, of the spinal cord; or of its nervous appendages. Do not misapprehend my use of that term, as if it had any definable meaning. I use it to denote the unknown cause of the symptoms we are considering; just as, in algebra, we take the letters x and y to express unknown numbers, the value of which we seek to discover. If we could solve our pathological problem, we should dismiss our x, our irritation, and substitute for it our a or b of algebra—the actual cause of the phenomena under our study and investigation. It is conjectured by Dr. Todd and Mr. Bowman that the changes which take place in the nerves, and in the nervous centres, whereby sensations and muscular contractions are produced, are molecular changes, rapidly propagated from the point where the stimulus is applied; and analogous to 'that remarkable change in the particles of a piece of soft iron, in virtue of which it acquires the properties of a magnet so long as it is maintained in a certain relation to a galvanic current; these properties being instantaneously communicated when the circuit is completed, and as instantaneously removed when it is broken. A *state of polarity* is induced in the particles of the nerve by the action of the stimulus, which is capable of exciting an analogous change in other particles, whether muscular or nervous; whence results the peculiar effect of the nerve's influence.'

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* This warning, suggested in the first delivery of these lectures, has been terribly justified by subsequent events. The names of Palmer and of Dove will ever retain an infamous celebrity in the annals of our criminal jurisprudence, for cold-blooded murderings by the poison of strychnia. Wainewright's case, which was less notorious, but of precisely the same character with Palmer's, had occurred previously. It forms the basis of Lord Lytton's well-known novel 'Lucretia.'

In accordance with this theory these authors hold, with great show of reason, that in tetanic spasm, the natural polar force of the spinal cord is greatly exalted, and kept so, by the constant irritation applied directly to the cord itself, or propagated to it by the nerves of the injured part.

If you *irritate*, mechanically, by means of a pair of forceps, the exposed spinal cord of a recently decapitated animal, a turtle for example, you produce spasmodic contraction of the limbs. What difficulty is there in supposing that some mechanical irritation existing within the spinal canal of a living man may have a similar effect? It may be, and probably is, sometimes, the mechanical irritation caused by the altered state of the bloodvessels under inflammation; for sometimes we do find traces of such inflammation in the spinal marrow after death by tetanus.

Again, if you irritate, by pinching, one of the spinal nerves of a turtle whose head has just been cut off—if you thus irritate one of these nerves in any part of its course, what happens? why the muscles of the limbs contract spasmodically; those on the side to which that nerve belongs become rigid, and those on the other side also. That property of the cord comes into play which I have so often mentioned: a property which it possesses independently of the brain; which it evinces when all communication with the brain is cut off; a property, therefore, which may be manifested without any exercise of volition, and even in spite of efforts made by the will to restrain its manifestation: I mean, of course, the property whereby it is capable of receiving impressions through the medium of its afferent nerves, from parts at a distance, and of originating motion in the muscles of the trunk and limbs through the medium of its efferent nerves. By the courtesy of the late Dr. Marshall Hall I had the opportunity of witnessing, in the headless turtle, the phenomena that I have been describing to you. Surely they throw a broad light upon the pathology of tetanus, and of sundry other affections. We infer from them, most legitimately as it seems to me, that the tonic spasm which characterises the disease we are considering, may be caused by a morbid condition of the spinal marrow itself; or of the nerves that belong to it. In the latter case, irritation is set up at the free extremity, or somewhere in the course, of incident nerves; along these nerves an influence is conducted to the cranio-spinal axis, in which a process or change takes place, whereby an answering influence is reflected along motor nerves to the muscles: and the whole circle of action and reaction is run through with the suddenness and swiftness of lightning, or of thought. You cannot expect that visible marks of the irritating cause should, in all cases, be left upon the body; any more than you could discern the pinch made by the forceps after they had been withdrawn. In cases of poisoning by strychnia the irritating material is doubtless carried in the blood.

When, in the experiments to which I have referred, Dr. Hall plucked at, or compressed, one of the denuded spinal nerves, spasmodic motions were excited in the muscles of *both sides*; and *above*, as well as *below*, the junction of that nerve with the cord. This shows that the change (whatever it be) that is wrought in the cord by impressions made upon one of its afferent nerves, is not necessarily confined to the corresponding *segment* of the cord; but may be instantly communicated, in both directions, throughout its entire course: the whole of this centre of the excito-motory system responding to the influence conveyed by a single nerve, as completely as a tight string vibrates from end to end, when struck at any one point. We frequently, indeed, find that the excited motions are more limited; but it is important to mark this ready consent of the whole cord, under sufficient excitement.

Dr. Hall has given certain distinguishing epithets to tetanus, according to the supposed source and locality of the irritation. When the irritating cause operates directly upon the spinal cord itself, he calls the disease *centric* tetanus: when it resides in some part of the body distant from the spinal cord, he calls the disease *eccentric* tetanus. These are good and intelligible names; and I shall take leave to adopt them.

Observe now how well this explanation meets the facts of the case. We sometimes find the spinal cord or its membranes inflamed, when there has been tetanic spasm. We then refer the spasm to the centric irritation. But in a far greater number of cases we can detect no marks whatever of disease in the spinal canal, while we know that an irritating cause has been applied to parts at a distance. Often we have evidence which is visible, that a nerve has been injured, torn across perhaps, or half torn, or compressed in some way or other; just as we might compress a nerve, with a pair of forceps, in a decapitated turtle. That experiment shows us that very slight irritation may be enough to produce the spasmodic action; and we find that slight injuries, as well as severe, will bring on the disease, when, by the operation of certain injurious agencies, the frame has been predisposed, and rendered morbidly susceptible. There is no part of the trunk or limbs which is not supplied with nerves from the spinal cord; and we find that injuries of various parts, or of almost any part, in an individual predisposed to take on the disordered action, may produce it. The exciting cause may be a wound irritating a particular nerve: it may be exposure to cold, acting upon the extremities of various nerves that proceed from the surface: it may be a bundle of worms, irritating the nerves spread upon the mucous tissue of the alimentary canal; for I omitted to state before that some writers, especially MM. Laurent and Lombard, have maintained that tetanus is almost always, even when it supervenes after wounds, the result of the presence of worms in the digestive organs. They have founded this opinion upon the *fact*, that worms have been very frequently indeed discovered in the stomachs or intestines of persons dead of this disorder. I think this is a point well worth attending to. It is objected that worms infest the human body without causing tetanus: but the very same thing may be said of the operation of cold; and of external injuries. Any of these may probably excite the disorder, when the body is preternaturally susceptible of it. The real mystery lies in this predisposition. We have reason to suppose that a high atmospheric temperature, continued for some time, is *one* predisposing cause; but how it operates, or what is that state of system in which the increased susceptibility consists, these are points concerning which we are really in the dark.

The disease is common enough in brutes: and it is frequently *eccentric* in them; brought on by injuries mostly of the extremities. Locked-jaw is a familiar term in the nosology of farriers. It is not uncommon in the horse after castration. Mr. Poland, in the 'Guy's Hospital Reports,' quotes a statement made by Hurtrel d'Arboval, that twenty-four horses were castrated on the same day at Bec, in the Department de L'Eure. They were afterwards led four times in the day through a pond of water supplied from a very cold spring: sixteen of them died from tetanus between the tenth and fifteenth day after the operation. I remember a mare belonging to my father dying of that disease a few days after foaling. It often results, in these animals, from a prick in the foot, by a nail, in shoeing. Dr. Parry noticed eccentric tetanus in lambs. 'I have often seen lambs,' says he, 'whose ears, for the purpose of marking them, have been bored with a red-hot iron too near the root, so rigid all over with tetanus, alternating with convulsions, that their bodies would project in a right line with their hind legs, when one held them out horizontally by the hind feet.' Dr. Mason Good tells us that parrots are frequently affected with trismus: a calamity which, supposing the bird to be within ear-shot, it would be difficult to commiserate.

We are not advancing any wild theory, then, respecting the controverted pathology of this disease, when we lay down the following propositions; that it is essentially a disorder of the excito-motor apparatus; that it results from irritation of a peculiar kind, affecting that part of the nervous system; that the irritating cause may be centric,—within the spinal canal itself; that, again, it may be, and often is, eccentric,—situated at the extremity, or somewhere in the course, of one or more of the afferent spinal nerves; and that a certain predisposition is for the most part necessary, to render the body susceptible of the disease under the operation of the exciting irritation.

At one time it was supposed that the physical cause of the disorder had been detected, in the presence of more or fewer thin scales of bony or earthy matter, lying in or upon the arachnoid of the cord. I have myself seen these after death preceded by tetanic symptoms. But tetanus often happens and proves fatal without them: and they are often met with when there has been no tetanus. If, therefore, there be any connection between these thin plates of ossification and the occurrence of tetanus (which may well be questioned), it must be of this kind; that the scales of earthy matter predispose the spinal cord, somehow, to be affected by the exciting causes of the disease.

Again, it had been thought that tetanus might occur, and prove fatal, without there being, from first to last, any permanent or demonstrable change in the spinal cord: that the strong and abiding muscular spasm was in some sort a warrant of its integrity; or at any rate afforded presumptive evidence against the presence of any deep or disabling damage to the nervous tissue. But this notion has been dispelled by the recent researches of Dr. Lockhart Clarke, who in six cases of fatal tetanus has found, by help of the microscope, signal structural mischief scattered throughout the cord, where nothing unusual could be detected by the unaided eye. His method of investigation is peculiar. He first hardens the nerve-matter by steeping it in a solution of chromic acid, which solidifies the blood in its vessels, and at the same time any fluids that may have exuded from them. He is thus enabled, after making thin slices of the hardened mass, to inspect, through the microscope, its minute structure, or changes of structure, without disturbing the relations of its constituent parts. In these tetanic cases he found the blood-vessels in many and various parts of the cord filled to distension; here and there a few blood-corpuscles extravasated; and a translucent and in some places a finely granulated substance, occupying the natural interstices of the tissues, and even lying within the nervous tissue itself, which it had torn up and displaced. This substance (which doubtless was coagulable lymph) lay, for the most part, close to the blood-vessels. There were numerous streaks and areas of this sort of disorganisation both in the gray and in the white matter of the cord, especially along the fissures in which the blood-vessels run; and there was some softening or solution of the contiguous nerve-tissue.

Disorganisation of exactly the same kind has more recently been discovered by Dr. Dickinson in the spinal cord of a man who died in St. George's Hospital eighteen and a half hours after the setting in of tetanic symptoms, and eight or ten days after the reception of the injury which led to them—a wound made by an iron spike through the palm of the left hand. The case is recorded in the fiftieth volume of the 'Medico-Chirurgical Transactions.' Here also the blood-vessels of the cord were dilated to many times their proper width, and crammed with blood-corpuscles so as to look like solid cylinders. In some places blood-corpuscles were extruded. More often the fluid portions only of the blood traversed the wall, to appear as the translucent structureless material which played so prominent a part in the destruction of the cord. 'That it was an exudation from the vessels, and not a product of the disintegration of tissue, is evident from the following facts. It constantly lay in contact with the vessels; and often it surrounded them. It lay, indifferently, in the gray matter and in the white, abundantly in the fissures, and occasionally outside the cord altogether, so as to destroy its symmetric appearance. It was the source of increase of bulk, of laceration, and of displacement, so as to suggest that it was an addition to the structure, and had been forcibly driven into it.'

'At the same time a certain amount of disintegration of the nervous elements had taken place, where the exudation came in contact with them, such as might result if (as suggested by Dr. Lockhart Clarke) the exudation had a solvent action upon the tissue.'

All the blood-vessels—arteries, veins, and capillaries—were more or less filled and distended; the capillaries the least. The exudation was in most frequent connection with the arteries; scarcely ever with the veins.

Have we, then, in detecting these hurts of the spinal cord, ascertained the physical cause of the disease, or rather of its distinctive symptoms? I think not. The very character of the lesions suggests the idea of a force exerted upon the arteries, corresponding with the actual force of the muscular contractions, and probably related to that force, or in simultaneous operation with it. They are changes which, when numerous and widely spread, would seem to forbid the hope of perfect recovery: yet recoveries from the milder form of the disorder appear to be perfect. Indeed we can scarcely think that these lesions exist, or exist to any extent, in its less severe non-traumatic forms, or in the transient identically tetanic condition produced by strychnia when it does not kill. I look upon them, therefore, as *effects* of the spasms: and I think it probable that the spasms may be sometimes caused by some altered quality of the blood; having the same kind of influence upon the cord as the poison of the nux vomica. In the traumatic cases especially, there is a period of incubation between the primary injury and the spasmodic outbreak, analogous to that which I shall have to show you is always noticeable in cases of specific fevers resulting from the introduction of animal poisons into the body. That even slight injuries done to the nervous matter may change in a remarkable way the qualities of the blood, is a well-established fact. A simple puncture made in the floor of the fourth ventricle of the brain will impregnate the circulating blood with sugar. There have been instances not a few, in which sudden terror, or rage, or other violent emotion, has so altered the milk (and therefore the blood) of a nursing woman, as to make it poisonous to the suckled infant.

The doctrines propounded by Dr. Marshall Hall, of which the importance becomes constantly more apparent, and by which his name will be enduringly connected with the physiology of the nervous system, receive a strong confirmation from the phenomena of tetanus. They furnish a key to many problems which had previously perplexed the pathologist; and they do this simply by distinguishing the proper functions of the two distinct nervous centres; the brain and the spinal cord. But the practical application of these views is yet in its infancy.

The *treatment* of tetanus is a mortifying subject. The disease is and has always been a lamentably fatal one. Hippocrates says, *ἐπὶ τρώματι σπασμὸς ἐπιγενόμενος, θανάσιμον,* tetanus supervening on a wound, is mortal: and the aphorism holds true, with very few exceptions, in the present day. Almost all the acute and severe traumatic cases are fatal. Hennen declares that he never saw a case of ‘acute symptomatic tetanus’ recover. Dr. Dickson found all curative measures followed by ‘unqualified disappointment.’ Mr. Morgan of Guy’s Hospital uses these words: ‘I have never yet seen or heard of an instance of recovery from acute tetanus.’ Another of Hippocrates’ aphorisms is, *ὁκόσοι ὑπὸ τετάνου ἁλίσκονται ἐκ τέσσαρσιν ἡμέρῃσιν ἀπόλλυνται,* they who are seized with tetanus die within four days: but he adds, *ἢν δὲ ταύτας διαφυγῶσιν ὑγιέες γίνονται,* if they get over this period they recover. And to this we can only add now, that those who survive the first few days, and ultimately get well, recover in a variety of different ways, and under various modes of treatment. But as to the mode of treatment which is to be preferred, or even as to the real efficacy of any mode, there is much room for doubt. Under every plan of management a vast majority die.

Let us briefly pass in review the principal remedies that have been tried, and enquire what degree of success has followed their employment.

One drug from which much benefit has been hoped for, is *opium*. In some spasmodic disorders it is of unquestionable service. Very large doses of it have been given and borne in tetanus; and some have recovered under its use, and more have died.

It is well known that pain fortifies the nervous system against the peculiar influence of narcotic substances. We need not, therefore, be surprised that opium, administered in enormous quantities, in this painful disease, has had but little effect. I was assured by a physician, with whom I formed an acquaintance in Edinburgh some years ago, and who is known, I find, to a student now present, that his own wife, while labouring under a tetanic affection, swallowed, in twenty successive days, upwards of 40,000 drops of laudanum, which is at the rate of more than four ounces a day; in all, more than two imperial quarts. The lady recovered. A case is recorded in the second volume of the 'Medico-Chirurgical Transactions,' in which an ounce of *solid* opium was taken, in divided doses, every day, for twenty-two days. This appears a more astounding instance than the former; but I am not sure that it was so; for, in this complaint, solid opium does not always dissolve in the stomach. I have heard the late Mr. Abernethy say that he had found enough undissolved pills of opium in the stomach after death, to poison a dozen healthy persons. This fact should teach you, if you resolve on trying opium at all, to use the hypodermic way of introducing it into the system.

It is sometimes a difficult matter to give any medicine by the mouth, so strong is the spasmodic contraction of the muscles that close the jaws. You cannot get the mouth open. Some persons set to work to heave it open, by levers; and it has been proposed, and I believe practised, to break off or extract a tooth or two, to make a passage for the introduction of medicine and of nourishment; but I hope you will never be guilty of such clumsy barbarity as that. Food and physic may be carried into the fauces and into the stomach by means of a flexible tube: and this may be inserted through the nostril; or through the mouth, by passing it between the jaws, behind the back teeth, where there is always an aperture that will admit a tube sufficiently large. A still easier method—easier and therefore better both for the patient and for his medical attendant—has been in use, I believe, for some time in

Lunatic Asylums. It is strongly recommended, after much experience of its value, by Dr. Moxey. The patient is supposed to be lying on his back, and restrained, should restraint be necessary, from moving. A small wedgewood funnel is then held in one of his nostrils, through which food, or drugs, in a liquid form, or of such consistence as to allow of its being *poured*, may be passed to the fauces, where the reflex action of the muscles of deglutition will catch and carry it onward to the œsophagus in spite of any effort made by the patient to prevent it. Whatever is so administered should first be *warmed*.

This expedient, though it may not be a pleasant one to the patient, is not painful, nor does it irritate the nostril so as to provoke sneezing, or to leave soreness. It is well fitted for various emergencies. It affords an excellent way of conveying an emetic into the stomach of those who are dead-drunk, or stupefied with opium, and who cannot, therefore, be made to take it in the natural manner.

After all, in respect of the cures that have been ascribed to the opiate treatment, they have all (so far as I know) occurred in cases of the milder or more chronic tetanus; and mostly in the idiopathic form of the disease; and this circumstance makes it a question whether they were *cures* at all; whether they were not simply recoveries.

Dr. William Budd (in a paper already referred to) challenges, on physiological principles, the propriety of giving any opium in this disease. He says, 'It has been ascertained that the effect of that drug is to excite, and not to quiet, the motor function of the spinal cord: indeed, it is well known that the motor acts of the cord may be rendered much more active and powerful, by giving, before decapitation, opium to animals that are to be subjects of experiment.' He considers 'these objections, furnished by theory, to be motives sufficient for the future exclusion of opium from the treatment of tetanus.'

I had long been aware that the effect of opium upon frogs was to produce tetanic spasms. But in no case of poisoning by opium in the human subject (and I have seen a great many) have I ever witnessed any approach to tetanus: and I much question the safety of arguing, in such matters, from what we know to happen in the inferior animals, to what we suppose would happen in man.

The failure, however, of opium in the severer forms of the malady, and its equivocal utility in any, taken together with these theoretical objections, prevent my *recommending* opium as a remedy for tetanus.

What is the result of experience in regard to *blood-letting* in tetanus? I am afraid, that, as a curative agent, it has very little power over the disease. Yet it may be, in certain cases, of use, as an auxiliary to other measures. When the disorder bears any aspect of inflammation—when, for instance, fever is lighted up, and pain is felt along the course of the spine, or when the approach of the spasm is marked by the supervention or the increase of pain in the wound—then our chance of doing good by blood-letting is the greatest. Some of the cases that happened in the Peninsular war, were decidedly benefitted by the abstraction of blood under such circumstances. I need scarcely say that though the bleeding, when adopted, should be early and free, so as to produce some sensible impression upon the system, yet we must always use this remedy with caution. The tendency of the disease is to exhaust the power of the heart; and if by one over-bleeding we bring that organ to a stand-still, it may refuse to begin again.

In a complaint which depends so much on irritation, and so often on manifest irritation of external parts, we look naturally to the *warm bath* for help. And it has been fairly tried: and some persons have found it useful; and others have found it useless, doing neither good nor harm; and some have condemned it as actually hurtful.

The *cold bath* has been extolled as a much more powerful agent than the warm; and so, doubtless, it is. But it is more potent for harm as well as for good. For example: a tetanic patient, in St. Thomas's Hospital, was plunged into a cold bath, at his own request. 'All the symptoms disappeared (says Mr. Morgan) in a moment; and he was almost immediately taken out of the bath; but he was taken out lifeless.' Sir James M'Grigor says that, during the campaign in Spain, 'the warm bath gave only momentary relief; the cold bath was worse than useless.'

However, the application of cold water to the surface has, in many recorded instances, been of at least temporary benefit and comfort: and in the West Indies, where the disease is common, the cold affusion still continues, I believe, to be the most favourite expedient. After it, the patient is rubbed dry, put to bed, and has laudanum administered. I have again to observe, of this remedy also, that it is chiefly serviceable in the idiopathic form of tetanus. It has been tried upon animals. Dr.

Parry says that it was quite unavailing in the case of certain lambs that had the disease. In a note, which I made at the time, of Mr. Abernethy's lecture on tetanus, I find the following statement: 'The effect of cold in diminishing excessive muscular action was strikingly shown in the case of a horse belonging to Professor Coleman, which had tetanus. The animal was slung, and carried out of the stable, and laid on the snow, which was then on the ground: and he was covered over with snow also. A horse affected with tetanus is a curious sight. His legs straddle, and become stiff; his ears are pricked up; and his tail sticks out. In this case, on the application of the snow, his ears sank, his tail became pliant, and the rigidity of his muscles was removed. He was again taken into the stable, and the spasms returned.' Mr. Abernethy said, that were he himself the subject of tetanus, he would desire to have the cold affusion tried. If you are willing to assay the same remedy, do not plunge your patient into a cold bath, but take him out of his bed on an extended sheet, pour cold water over his body, wipe him dry, and place him in another dry bed. This may sometimes, for a time at least, diminish the spasmodic action; and the patient may sometimes sleep comfortably after it.

The late Dr. Todd first suggested to me the application of *ice* along the *spine*; a measure which he had found eminently beneficial in convulsions. This mode of employing cold as a remedy in tetanus has always seemed to me well worthy of trial. It has the advantage of not inflicting any shock which might excite or disturb the reflex function of the cord, through its incident nerves. Dr. Chapman's ice-bags, now readily procurable, furnish an excellent means of applying the remedy. Indeed it has been so tried, and with apparent success; but then, again, the disorder was of the milder type.

LECTURE XXVIII.

Treatment of Tetanus, continued. Wine; Mercury; Purgatives; Digitalis; Tobacco; Musk; Prussic Acid; Belladonna; Carbonate of Iron; Oil of Turpentine; Wourara; Chloroform; Surgical Expedients; General Rules. Hydrophobia.

In the last lecture we considered the symptoms, the nature, the causes, and to a certain extent the treatment, of that terrible malady, *tetanus*. There is good reason for believing that it is essentially a disorder of the excito-motory apparatus: that it is caused by irritation of a peculiar kind, affecting that part of the nervous system, and producing tonic spasm of the voluntary muscles: that the irritating cause may be centric, situated within the spinal canal, and applied directly to the cord; or eccentric, situated out of the spinal canal, applied to some part of one or more of its afferent nerves directly, and thus influencing indirectly the cord itself, and through it the reflex motor nerves: that a certain ill-understood state of the system is necessary, a certain aptitude to take on the disease, before the exciting cause can be efficient: and that one circumstance which has been ascertained to tend to the production of such an aptitude, is a long-continued high temperature of the atmosphere.

I mentioned several remedies and plans of treatment which have been fairly tried, and mostly tried in vain, for the removal of this disease. The severe cases, and especially the severe traumatic cases, almost all prove fatal; the less severe cases, those in which the paroxysms are less violent and less frequent, and which run on for several days, sometimes terminate in health: whether in consequence of the measures employed, or whether in spite of them, it is not easy to say. The idiopathic cases, as they are called, those which appear to be produced by exposure to cold and wet, are usually the less severe, and the more hopeful. The remedies that have been tried, and which were mentioned in the last lecture, are opium; blood-letting; the warm-bath; the cold-bath. I showed you that, under each of these remedies, a great number of patients died, and some recovered; and that the recoveries had been almost exclusively amongst those patients in whom the disease appeared originally in its milder form. So that whether the complaint was actually cured in any of these cases, whether, *i.e.*, any single patient recovered, or recovered sooner, from using any of these remedies, who would have died, or in whom the disease would have been protracted, if he had *not* used them, is a matter of uncertainty.

The celebrated American physician, Dr. Rush, regarding the disease as essentially a disease of debility, and looking, probably, at its common tendency to death by asthenia, wrote a paper to recommend the employment of bark, and wine, and spirits, in full doses. It is curious enough, but quite in agreement with what has been already stated of opium, that how much wine soever may be swallowed by the patient, nothing like intoxication is produced by it. The system resists the ordinary influence of the alcohol. In one instance related by Dr. Currie, the disease lasted six weeks, and in that space of time the patient drank 110 bottles of port wine. The same author mentions a remarkable case, in which a horse, which was attacked by tetanus, and happened to be a great favourite with its master, was treated with wine, and got well, after swallowing more port wine than he was worth. Whenever *this* plan has appeared to do good, it has been in the more chronic variety of the complaint.

Mercury, you may be sure, has not been left untried. It is said that the system is slow in submitting to its influence, in this malady. The specific effect of mercury upon the gums is not, however, so strongly resisted as that of wine or opium upon the nerves. Nor can we be surprised at this, when we consider that in tetanus the functions of organic life are, comparatively, but little involved. It is clear that there is not time for any effectual exhibition of mercury in those severe cases that are early fatal. In its more chronic form the disorder has been known to yield upon the mouth becoming affected. This happened, if I mistake not, in Mr. Mayo's patient, mentioned in the last lecture. Tetanus has sometimes, however, commenced while the patient was in a state of salivation. Dr. Wells has recorded three instances of that kind. The experience of the military surgeons who were in Spain, is, upon the whole, against the reputed efficacy of mercury. We must take care not to conclude too hastily, that because a patient uses a certain remedy and recovers, he recovers through the operation of that remedy: any more than we should conclude, if he recovered during a general election, that the election had cured him. Yet this absurd and unsafe mode of reasoning is for ever employed in regard to disease, by the public; and too often, I fear, by ourselves.

Purgatives have been much given in tetanus; and sometimes with manifest advantage: I mean in the less severe cases. But very large doses are commonly required to procure evacuations from the bowels. Whether the torpor of the intestines be always the effect of the disease, or whether it may not sometimes be, in part at least, a consequence of the opium that is given, I am not sure. When they do act, very unnatural motions are frequently produced. Mr. Abernethy tells us of a hospital patient of his who recovered under the use of purgatives; they were long before they had any effect, and when they did at last operate, such fœtid stuff came from him, that no one who could crawl out of the ward would remain in it. He says also that the nurses, in other cases, have reported the stools to be more like sloughs than fæces. Enormous quantities of drastic purgatives have been given. You may read an instance of this in the second volume of the 'Medico-Chirurgical Transactions.' It is related by Mr. Harkness. There is a still more extraordinary case detailed by Dr. Briggs, in the fifth volume of the 'Edinburgh Medical and Surgical Journal.' In little more than 48 hours, the patient in that case took 210 grains of scammony, 89 of gamboge, 80 of calomel, an ounce and four scruples of jalap, and $2\frac{1}{3}$ pints of what we call *black dose*, the infusion and tincture of senna: and all this without either sickness or griping; but on the contrary, with the most decided benefit. In the first week of his disease, the patient swallowed—of calomel, 280 grains; scammony, 260; gamboge, 110; jalap, 3 ounces and 10 grains; infusion of senna, $5\frac{5}{6}$ pints. And altogether in the first 25 days—of calomel, 320 grains; scammony, 340; gamboge, 126; jalap, 5 ounces and $7\frac{1}{2}$ drachms; infusion of senna, $10\frac{2}{3}$ pints; besides an ounce and a half and 35 grains of the colocynth pill. I mention all this to show what the system will bear, under the bondage of the disease; not as an encouragement to you to prescribe such doses.

It is certainly proper and necessary to clear out the bowels, and to endeavour to correct unhealthy secretions; yet numerous evacuations, the act of going to stool often repeated, should be avoided. Under such obstinacy of the bowels, the croton oil would perhaps be the most eligible purgative.

Foxglove and tobacco are two medicines, or rather poisons, which have been used; both, probably, upon the same principle. Their effects, when full doses have been given, are much alike;

sickness, faintness, feebleness and fluttering of the pulse, coldness of the surface, with that slack and passive state of the muscles which belongs to syncope. But if we consider that the influence of these substances upon the involuntary muscles, especially upon the heart, is more certain and decided than upon the muscles of voluntary motion, which are the muscles involved in the tetanic spasm, and if we take also into account the strong disposition observable in tetanus towards death by asthenia, we shall scarcely be prepared to expect any good, but the contrary, from large doses of digitalis, or from tobacco; especially in the latter periods, when, so far from obviating the tendency to death, they would seem to co-operate with the disease in extinguishing life. However, if the result of experience were clearly in their favour, we should not be warranted, by mere theoretical views, in withholding these drugs. The army surgeons, some of them, have fancied digitalis useful. Sir James M'Grigor mentions a case in which it caused a relaxation of the spasms; but the man died afterwards, apparently from the effects of the remedy. And this is just what I find with digitalis. When given in large doses (and small ones here must be useless) it becomes unmanageable. Certainly we have no such accounts of its sanative power as would induce me to give it with much expectation of success, or to give it at all.

The tobacco is not given by the mouth, but thrown up into the rectum: either the smoke of its burning leaves, or (what is probably as efficacious, and I should think more uniform and less unsafe) an infusion of them in water. Mr. Curling, after analysing a large number of cases of tetanus, thinks tobacco the best remedy we at present possess. Mr. Travers was of the same opinion. However, I should recommend great caution in the use of this ticklish remedy. You ought to know that, when injected in other emergencies, in strangulated hernia, for example, mortal syncope has followed such enemata.

Musk, in large doses, has been strongly recommended by a Frenchman, Fournier-Pescay, who has written on this disease. He gave ten or twenty grains at intervals; so that a drachm, or even two drachms, were taken in the course of the day; and he declares that he found it more efficacious than anything else that he had tried.

Prussic acid and *belladonna* are said by Dr. Elliotson to have been freely prescribed, and to have failed; whether in his own hands, or in those of others, I do not know.

There is another remedy which the same physician has employed; and employed not without success: *the carbonate of iron.* Reflecting, he tells us, upon the virtue of this medicine in another complaint which has some points of analogy with tetanus, viz., chorea, of which I shall soon speak, and considering how miserably narcotics had failed, he determined to give the carbonate of iron a fair trial upon the first opportunity. He has published some account of its effects, in tetanus, in the 'Medico-Chirurgical Transactions.' In the first case in which he used it, the tetanus supervened upon a compound dislocation of the great toe. The method in which the remedy was administered was this. The carbonate was made into an electuary by mixing it with twice its weight of treacle. The electuary thus made was well stirred in beef-tea just as the patient was about to drink it. He took this every two hours, as much as he could swallow: and he got well. The next case is described as being a very severe one; it resulted from a contusion of the thumb. Dr. Elliotson says that he never saw a case, *which did well*, that was more severe. This patient also took the carbonate of iron, as much as could be got down; and that was about two pounds a day. He had injections twice daily, to keep the bowels unloaded: and the iron is described as having come away in large red lumps, in shape like horse-dung. This man recovered. In a third case, where a chilblain above the heel was the exciting cause, the boy died within twenty-four hours of the time when the remedy was first prescribed. To produce its influence upon the system (Dr. Elliotson observes, very truly) iron must be given *for a few days*: nay, he holds that months sometimes elapse before it has any effect. So that if it really be useful in tetanus, we cannot expect much good from it in the more acute cases: and these are the cases for which we want a remedy.

Oil of turpentine is one of the many substances that have been praised as useful in tetanus. Now, bearing in mind its power (which I shall hereafter describe, but which you must at present take for granted) as a worm-killer, and also the frequency with which worms are met with in the stomach and bowels after death by tetanus, this is one of the drugs which I should employ as a *purgative*, taking my chance of whatever good might possibly arise from its specific or anthelmintic qualities. It may be given in such cases either by the mouth, or in an enema, or at both ends together: but it must be given in large doses, not less than an ounce at a time; and it may be mixed with an equal quantity of castor oil. The one oil dissolves, or becomes incorporated in the other.

The ascertained beneficial influence of large doses of the bromide of potassium upon some other grave disorders of the nervous system, is persuasive of a fair trial of that drug in tetanus. Whether any such trial has hitherto been made, I do not know.

I have never been an experimenter with new and untried drugs. There are, however, fortunately perhaps, ingenious men who try to reason out probable or plausible remedies: seldom, I think, with much success. The virtues of all our best medicines have been discovered, as I formerly told you, empirically, often by mere accident. Nevertheless, when we have to deal with a disease so desperate as tetanus, we may well listen to any promising suggestion. Some years ago Mr. Morgan, acting on the principle *contraria contrariis curantur*, proposed to give such poisons as are known to cause paralysis, with the view of countervailing the undue action of the muscles in tetanus. And the experiment was made by Professor Sewell of the Veterinary College; and Mr. Mayo has given this report of its result. 'A horse, suffering from a severe attack of tetanus and locked-jaw, the mouth being too firmly closed to admit the introduction of either food or medicine, was inoculated on the fleshy part of the shoulder with an arrow-point coated with the wourara poison. In ten minutes apparent death was produced. Artificial respiration was immediately commenced, and kept up about four hours, when reanimation took place. The animal rose up, apparently perfectly recovered, and eagerly partook of corn and hay. He was unluckily too abundantly supplied with food during the night. The consequence was over-distension of the stomach, of which the animal died the following day, without, however, having the slightest recurrence of tetanic symptoms.' I had fancied that the death had resulted from some injurious effect upon the lungs, produced by artificial breathing. But I have little doubt that Mr. Mayo derived his statement from Mr. Sewell himself.

This notion of antagonistic properties inherent in different poisons, chiefly vegetable, has been more scientifically raised at a later period. Thus, opium contracts, and belladonna expands, the pupil of the eye. The one poison may therefore, it is said, become the antidote of the other. And this theory has been put to the test, and there is recorded experience in favour of its soundness. Again, strychnia produces artificial tetanus, the wourara poison suspends the action of the voluntary muscles. Therefore prescribe the wourara for a patient poisoned with strychnia, or for a patient labouring under tetanus.

It is singular that each of these two substances are obtained from the same genus of plants. M. Vulpian—a profound physiologist, a skilled experimentalist, a keen and cogent reasoner—has satisfied himself that the wourara, or curare, 'breaks the physiological communications which subsist, in the state of health, between the nerve fibre and the muscular fibre; renders impossible the action of the nerve fibres upon the muscles; abolishes the functions of the motor nerves.'

It has not the same paralysing effect on the heart; and an animal apparently killed by it will at length recover, the effect of the poison passing off, if the circulation be kept up by artificial respiration.

As either of the two poisons, strychnine and wourara, may easily prove fatal to life, it must need acute observation, and a nice mental balance, in him who undertakes the conduct of a duel between them for the mastery of the *corpus vile* of a dog or a donkey. Still more anxious and fearful must be the superintendence of a trial of these poisons upon the human body under disease.

However, the wourara *has* been tried in cases of tetanus, and recovery has taken place under its use; not, however, so far as I know, from the severer forms of traumatic tetanus. In the late Italian campaign, a M. Breschin gave it to three men who were affected with traumatic tetanus in the French Military Hospital at Turin. One of the patients recovered, the others died; but even in them the remedy is said to have produced calmness, and relaxation of the muscular spasm. It has been tried in this country also, unsuccessfully.

The virtue of the vapour of chloroform has, you may be certain, been put to the proof in this painful disease; and not without marked relief of suffering. That it would prove equal to the cure of the severer cases, which would end fatally without it, was always, in my mind, a matter of hope rather than of expectation. Of its powers to allay the tetanic spasms excited by a poisonous dose of strychnia, and so to mitigate at least the danger, I cite the following instance, derived from an American journal.

A lad, aged fifteen, swallowed, by mistake, about two grains of strychnia. Dr. Jewett (of Boston) saw him thirty or forty minutes afterwards; and found him with a livid countenance, protruding and injected eyes, a full, strong, and irregular pulse, and his skin bathed in perspiration. Violent tetanic spasms, like the effect of shocks from an electrical battery, occurred in rapid succession. If they relaxed for a moment, the slightest touch of the surface of his body, the presenting of anything to his mouth, brought them on again with redoubled violence. Chloroform, inhaled with difficulty at first, subdued the spasms in ten minutes; but they returned whenever it was suspended. Partial anæsthesia was kept up for about four hours and a half, when it was finally discontinued. The recovery of the boy was rapid.

I have but little to say concerning what may be called the surgical treatment of traumatic tetanus. It was a natural thing, the source of the irritation being supposed to be the wound, to expect relief from amputation of the limb. But that will not arrest the morbid action after it has once been fairly established. Dr. Elliotson says he has searched scores of books, and found only one case in which the limb and the disease were lopped away together. However, Mr. Blizard Curling, in his 'Essay on Tetanus,' refers to seven instances of recovery, after the injured part had been amputated. Yet he states that 'it is almost impossible to ascertain with certainty how far the amputation, in these cases, was of service.' I believe I cannot offer you better advice on this subject than may be gathered from the concluding remarks of a very distinguished and philosophical surgeon, in his lectures on this disease. I allude to the late Mr. Abernethy, whose pupil I had the good fortune to be. He said, 'The state of the part injured is not the sole cause of tetanus. In cases of tetanus I have often amputated injured fingers; and though I did not thereby save my patients, yet I think that the symptoms were mitigated after such amputations. In such cases, then, I would not amputate any considerable member; nor even a small one, unless I thought that, from the injury sustained, it would prove useless to its possessor, even though the case should terminate favourably.'

The tourniquet has been applied to the hurt limb; but not, so far as I know, with any good effect. The most promising expedient which surgery offers is the division of the principal nerve proceeding to, or rather from, the seat of the injury. This, supposing the nerve to be known and accessible, is less formidable, less severe, less hazardous, less maiming, and, if we may judge from past experience, more effectual too, than amputation of the part. Dr. Murray has recorded (in the eleventh volume of the 'Medical Gazette') a very interesting case in which the operation was followed by most decided and instant relief. The patient was a young midshipman, who having trodden on a rusty nail, which pierced the sole of his left foot, had kept watch the same night upon deck, the weather being very cold. The disease began the next day, and the symptoms ran high. It was a case, therefore, of severe or acute tetanus. Without loss of time the posterior tibial nerve was divided. The limb was previously cold, and as the patient said, dead, and he had little power of moving it. He could not articulate distinctly, on account of the closed state of his jaws. The nerve was cut through by one stroke of the scalpel; and 'immediately (says Dr. Murray) he opened his mouth with an exclamation; and on looking at his countenance I was astonished at the striking improvement in it. I asked him how he felt, and he said he was already much better, and that his leg had come to life again.' Some stiffness of the jaws and neck remained for a day or two; but he soon recovered. Dr. Murray refers to another case mentioned by Baron Larrey, in which division of the nerve had a similar result.

Probably, to be successful, the operation must be *early*; before the morbid condition peculiar to the disorder has had time to root itself in the nervous system, or to taint the blood.

Though I am not a surgeon, I venture to advise you, in any case of traumatic tetanus that you may meet with, to examine closely whether any foreign substance may not have been left undiscovered in a punctured, or gun-shot, or other wound. Dr. Alfred Taylor mentions two instances of such oversight. In both instances the wound had healed over before the tetanic symptoms set in. In one of them a piece of rusty iron was found under or beyond the cicatrix, and pressing upon a nerve; in the other, a splinter of wood.

Although, in the present state of our knowledge, there is no one remedy or plan on which we can rely for the cure of this fearful malady, we may with much confidence lay down certain general rules, the observance of which will secure to the patient the best chance of a favourable result.

Since any, the smallest, movement or impression made upon the surface, or upon the senses, will bring on the severer degrees of spasm, it is of primary importance to protect the patient against these sources of trouble, so sure to aggravate his sufferings, and so likely to augment his danger. Hence if blood-letting should be thought advisable, it should be done early, sufficiently, and once for all. There should be no repetition of venæsection, or of cupping, or of leeches, unless the circumstances and progress of the case plainly encourage or demand them. The same remark applies to the frequent use of purgatives. The bowels should be well cleared in the outset, and then let alone. The patient should lie in a darkened room; from which noise also should, as much as possible, be excluded. He should not be surrounded by a multitude of friends or attendants. He should be enjoined to speak, to move, to swallow, as seldom as he can. In the severe traumatic cases, the nerve, in my judgment, should be promptly divided; and as high up in its course as may be practicable. And in all cases, there being no special indications to the contrary, I should be more inclined to administer wine in large doses, and nutriment, than any particular drug. If the tendency to mortal asthenia can be staved off, the disturbance of the excito-motory apparatus may, perchance, subside or pass away.

There is a form of this complaint called *trismus* or *tetanus nascentium*. As the name implies, it occurs in newly-born infants. It is very frequent and very fatal in the West Indies; coming on usually in the second week after birth. Hence it has been called 'the ninth-day disease.' Another of its names in the British settlements there, is 'the jaw-fall;' from the circumstance that shortly before death the lower jaw, which had previously been firmly pressed against the upper, drops on the breast. It has been said that a fourth of the infant negroes in Jamaica used to die of this disorder. Some persons refer it to the irritation produced by the retention of the meconium in the intestines; others, with more likelihood, to irritation from the wound left after the ligation and section of the navel string. A dose of purgative medicine appears to be the most hopeful remedy. The complaint is common, I am told, in ill-ventilated lying-in hospitals. Pure air must therefore be desirable as an adjuvant.

Tetanic symptoms sometimes occur (but I should think very rarely) in ague. Or paroxysms of tetanus return at regular intervals, and terminate by profuse perspiration: the patient being well during the intermissions. When such phenomena arise, the treatment proper in severe forms of ague must be adopted: what that treatment is, I shall in no long time be able, I hope, to lay before you.

Again, tetanus is occasionally a symptom in hysteria: and then the treatment applicable to hysteria must be had recourse to; especially enemata containing oil of turpentine, or the same medicine given by the mouth; and the cold affusion.

If the disease of which I have been speaking be dangerous, and very often fatal, in spite of all remedial measures, that which I propose to bring next under your attention is still more appalling; for I believe that hitherto it has been uniformly mortal. I know not that anyone has ever been rescued by art, or recovered by the efforts of nature, from *Hydrophobia*, after that frightful disease has once declared itself by its characteristic symptoms. The nature of those symptoms, and the absence of all definite or constant traces of organic change in the dead body, sufficiently mark the disease as belonging essentially to the nervous system, and as being essentially a *spasmodic* disease also.

What are the symptoms, stated in broad outline? These. Excessive nervous irritability and apprehension; spasmodic contractions of the muscles of the fauces, excited by various external influences, and especially by the sight or sound of liquids, and by attempts to swallow them; and extreme difficulty, amounting sometimes to impossibility, of drinking.

This is one of the diseases which are produced by animal poisons; and its course will be most conveniently traced if we include in our description of it the very first step towards its production—the application of the specific poison to the body. A man is bitten by a dog. After a time the symptoms proper to hydrophobia come on. After another, but much shorter, interval, the man is dead. Before we advert to the very many interesting points of enquiry which arise out of the contemplation of this malady, let us follow the tragedy a little more closely from its commencement to its closing scene.

A person is bitten, then, by a mad dog. Does the existence of rabies in the animal modify in any obvious way the injury thus inflicted? No; the wound that is made behaves, to all appearance, just as it would have behaved if the dog had not been rabid; and it gradually heals. After an uncertain interval —which lies, *for the most part*, between four weeks and three months, and which has been called the period of *incubation*— the following symptoms begin to be noticeable. The patient experiences pain, or some uneasy or unnatural sensation, in the situation of the bite. If it have healed up, the cicatrix tingles, or aches, or feels cold, or stiff, or numb; sometimes it becomes visibly red, swelled, or livid; on one occasion a papular eruption took place around it; sometimes it opens afresh, and discharges a peculiar ichor. The pain or uneasiness extends from the sore or scar towards the central parts of the body: i.e., if the bite have been inflicted on a limb, the morbid sensations extend towards the trunk. All this gives fearful warning of what is about to happen. This period is called the period of *recrudescence*. I believe it seldom fails to occur, although sometimes it is not noticed; the attention of the patient, and of his medical advisers, being absorbed by the horrible sequel. Very soon after this renewal of local irritation—within a few hours perhaps, but certainly within a very few days, during which the patient feels uncomfortable and ill—the specific constitutional symptoms begin: he is hurried and irritable; speaks of pain and stiffness, perhaps, about his neck and throat; unexpectedly he finds himself unable, though thirsty, to swallow fluids, and every attempt to do so brings on a paroxysm of choking and sobbing, of a very distressful kind to behold. 'Miserrimum genus morbi (says Celsus); in quo simul æger et siti et aquæ metu cruciatur.' This continues for two or three days, till the patient dies exhausted; in the way of asthenia.

I have seen three, perhaps four examples of this terrific malady. As they constitute the whole of my personal experience in the matter, I shall relate these cases.

The first occurred in the year 1826, in the person of a coachman, the back of whose right hand had been struck, ten weeks previously, by the teeth of a terrier dog: but, as both the patient and his fellow-servants declared, there was no wound made, no blood drawn, no breach or lifting of the skin; but merely an indentation, showing where the animal's teeth had pressed. He was brought to St. Bartholomew's Hospital on a Tuesday. On the preceding Thursday his hand had become painful, and swelled a little. On Friday the pain extended into the arm, and became more severe. His wife stated that he had been in the habit of sponging his head and body every morning with cold water, but that, on this morning, he refrained from doing so, on account of some feeling of spasm about his throat. His own remark on this was, that 'he could not think how he could be so silly.'

On Saturday the extent and the severity of the pain had still further increased. On this and the preceding night he got no sleep. He felt ill and drowsy on the Sunday, but drove a carriage to Kensington Gardens: he was, however, obliged to hold both whip and reins in his left hand. The pain extended to the shoulder. He was then bled. A slop-basin full of blood was taken, with much relief to the pain; and purgative medicine was given, which operated well.

The next day he complained of 'feeling very ill all over,' and he told his medical attendant that he could not take his draughts, because of the spasm in his throat. That gentleman (Mr. Macdonald), concealing his own suspicions as to the true nature of the disease, said, 'Oh, you don't like the taste of your physic! drink some water.' But he declared he had the same difficulty with water. The next day he came to the hospital. When there, water was brought and placed before him in a basin, for the alleged purpose of allowing him to wash his hands. It did not seem to disturb him, nor to excite any particular attention. Water was then offered him to drink, which he took, and carried to his mouth, but drew his head from it with a convulsive shudder. After this, on the same morning, he was much questioned by several persons about the supposed cause of his illness; and water was again brought him, which agitated him, and he became exceedingly distressed and unquiet, complaining of the air which blew upon him.

I first saw him myself soon after this. He was then, to all outward appearance, well; lying on his back, without spasm, without anxiety; his face somewhat flushed. He said he had a little headache, but no pain in the arm. His pulse was 132, full, and strong; his tongue moist, and slightly furred. He appeared to be a very quiet, good-tempered man; and smiled generally when he was spoken to.

I was naturally much interested by this case, and at nine in the evening I visited the patient again. He was composed and tranquil. Gruel was mentioned, and then he sighed two or three times deeply; then sat up, and after a moment's look of serious terror, took half a spoonful of the gruel in a hurried gasping manner; and said he would not take more at a time, lest *the sensation* should come on. He was desired to drink the last portion of the gruel from the basin. He accordingly seized it with hurry, carried it to his mouth with an air of determination, and then a violent choking spasm of the muscles about the throat ensued, the sterno-mastöidei starting strongly forwards. Most of the gruel was spilled over his chin; and he observed that he had been too much in a hurry, or he should have managed it.

The treatment consisted in full doses of opium, repeated at frequent intervals. On this visit to him I noticed, that while attempting to take some of the gruel with a spoon, he seemed inclined to doze as he sat. Otherwise there were no signs of his being overwhelmed, or even sensibly affected by the opium, unless indeed his general quietness was the consequence of it. He was quite rational and calm, except when attempting to take fluids.

On the Wednesday, at noon, he was nearly in the same state, but said he was better. In the course of the night some morsels of ice had been given him: with considerable effort he swallowed two or three of these; the third or fourth caused so much spasm, however, that he was obliged to throw it out of his mouth: but so great was his resolution that he seized it again, and, by a strong exertion, succeeded in swallowing it. He complained now that his mouth was and had been clammy; and he champed much, and spat out a good deal of tough mucus. At his own request, and (as he said) that he might injure no one, a strait-waistcoat was brought, which he assisted in putting on. But he was perfectly tranquil then.

I now had an opportunity of seeing him take some arrow-root. He sat up in bed to eat it; and before attempting to do so, he made hurried inspirations, and sobbings precisely resembling those which occur when one wades gradually into cold water. He swallowed small quantities of arrow-root eight or nine times, with hurry and difficulty, and with sighs that succeeded each other rapidly. He said that he felt the upper part of his throat narrower than it should be. He continued to take laudanum mixed with sugar and bread into a kind of pulp.

By the evening of that day the disease had not made much further progress. He again sat up and tried to eat some thinnish gruel. While taking the basin into his hand, he drew back his head to a distance from it, apparently involuntarily. He took one half-spoonful with effort and distress, then sighed deeply and rapidly, or rather his breathing consisted of a succession of sighs at short intervals: he gave up the basin, and sank back on his pillow still sighing. In the course of that night he ceased to take the laudanum; he could no longer attempt it. The next day he was still composed, though more easily irritated; and it was found that he had lost the power of moving his left arm. His pulse was 140, and much weaker than before, and his mental powers were failing. He gradually sank, and died in the evening, having repeated the Lord's Prayer an hour previously. During the last hours of life he had been moaning, and tossing from side to side: his bowels were purged; fluid stools ran from him, and distressed him greatly. His feet and legs first became cold, and the coldness extended by degrees up to his chest. He hawked up in the course of the day a considerable quantity of ropy mucus, and much frothy saliva came from his mouth towards the close. As his wife was wiping this away, his teeth, whether by convulsive accident or otherwise, came in contact with her finger, and drew blood. The part was cut out; and no bad consequence followed that I know of.

The examination of his body threw no satisfactory light upon the essential nature of the disease. Blood and serous fluid escaped on the removal of the calvarium. The vessels of the membranes were full, and the brain itself was mottled somewhat by its vascularity. There were a few spots of ecchymosis on the heart. The back part of the tongue was very vascular. The stomach presented the most notable appearance. There was a quantity of brownish-coloured mucus on its inner surface, and the mucous membrane had disappeared from a space about four inches in diameter at its left and larger end. That space alone was diaphanous; its edges sloped inwards; and a segment of this thin place looked exactly like a piece of china. On a white ground, there were inosculating vessels, some of them blue, and some of them of a coffee-coloured brown. I conclude that this appearance was produced by the action of the gastric juice after death.

This was in some respects a remarkable case. It was remarkable for its duration. Sir James Bardsley, in the article on Hydrophobia in the 'Cyclopædia of Practical Medicine,' states that the patients 'invariably go on from bad to worse, and finally die before the sixth day.' Now if we reckon that stage of the complaint here referred to by Sir James Bardsley to have begun on the morning of Friday, when he was obliged to omit his sponging because of the spasm about his throat, this patient did not die till the middle of the seventh day. In fact it was a very protracted case; and the symptoms were less violent than usual. Whether this was owing to the opium he took, or not, it would be difficult to determine.

In the second of the cases which it has been my lot to witness, the characteristic symptoms of hydrophobia were more faintly pronounced than is usual.

On my arrival at the Middlesex Hospital, on Thursday, the 5th of October, 1837, I was told that a patient had been admitted (under one of my colleagues) labouring probably under hydrophobia. He had applied at the hospital in the middle of the night; but was then sent away, after receiving some aperient pills, with assurances that he was only feverish and nervous. On his re-application in the morning he had been admitted.

I found him in the ward: a man twenty-five years old, of dark complexion and hair. He expressed his conviction that he was afflicted with hydrophobia; and said he was prepared for his fate. I observed that every now and then he suddenly sighed in a very peculiar manner; just as I had seen the former patient sigh. This would happen sometimes in the middle of a sentence, while he was speaking. He told us he had been bitten by a dog in the latter end of July; the dog was swimming, and like to drown, in a canal, and upon his reaching over to lift him out of the water, the animal seized upon his hand. After dragging the dog out, he beat him for his ingratitude; and then the dog ran off, and was pursued by a mob of boys, who had previously been pelting him as a mad dog. There was a scar on the middle finger of the right hand; the nail of that finger had (he said) been torn through, and each of the two adjacent fingers had been more slightly bitten. His pulse was 84; but varied in frequency at short intervals.

He acknowledged that after receiving the bite he was uneasy as to its possible effects, and read books about hydrophobia at the time: but he affirmed that he had afterwards ceased entirely to think about it. He had persuaded himself that the dog could not be mad, from its being in the water. On Tuesday, if not earlier, he had been uncomfortable and restless; and on Wednesday he found he could not swallow liquids. On one of these days he experienced a slight pricking sensation, without any redness or tenderness, in the site of the scar; his right arm and leg seemed to himself hotter than the opposite limbs; and the arm, though not tender, felt raw, and he could not bear the light contact of his clothes upon it. He became feverish also. From time to time a slight expression of terror passed across his features, and then he made a sudden, deep, sighing inspiration: at other times his breathing and appearance were perfectly natural. It was said that when some water was brought him he drew himself back from it with horror. He talked a good deal.

I saw him eat rice, made pulpy with milk. He took it without looking at the spoon, from which he averted his eyes, and ate several mouthfuls, in a gulping manner, and with evident effort. His bowels had been purged by the pills, and he declared that the noise of the water in the water-closet had distressed him. The sound of some water poured from one vessel into another by the patient in the next bed, had also agitated him. So did the contact of my cold hand on his arm; and currents of air, even the breath of anyone speaking to him; so that he insisted on conversing with the apothecary in such a position that the chin of each was upon the other's shoulder. But there was no actual or apparent spasm.

At this time he affirmed that the presence of company cheered him, and did him good; and begged that he might not be removed into a separate room. And he wished for some amusing book that he might read.

In the evening I again went to see him. He did not seem worse, though he said 'his symptoms were increasing.' He had taken a dose of musk and some morphia.

The next day I found the hospital in some confusion. Between eleven and twelve o'clock in the preceding night some of the officers of the hospital had gone to his bed, while he was apparently asleep, and certainly very quiet. They asked him if he would like some water. This seems to have greatly excited him; and immediately after their departure he rushed out of bed, (terrified, he said,) became furious and unmanageable, and was never again tranquil till he died, at about the same time the next night. He was now put into a room by himself; and, taking advantage of the momentary absence of the nurse, he bolted himself in alone; and declared he would admit no person but her. The door was at length forced, and a strait-waistcoat was put upon him. He then became quieter in his manner; begged that no unnecessary violence might be used; asked to be poisoned; spat at some of the bystanders, and reproached them, talking rapidly and wildly like an insane person; yet loudly and angrily imposing silence on everyone who addressed him. He said he could not bear to hear anyone speak; that he did not like my bass voice. Then he would sneer at the students, and say they showed bravery enough now he was confined: 'was it right for young gentlemen of education to stand there gazing with curiosity on a dying man?' asked for bread soaked in water, and when it was held towards him, snatched it with his mouth in a savage manner; spoke of his 'poisoned tooth,' and talked perpetually. He took a fancy to one of the students, and begged that he might remain with him.

About this time he vomited some yellow fluid, and thought he felt the better for it, and asked for an emetic; and some tartarised antimony was given him. He was now pale, and his lips were livid; but none of the distinctive spasmodic attacks occurred: indeed water was not at this time suffered to be brought near him. This circumstance it was, this absence of the peculiar spasmodic paroxysms which characterise hydrophobia, that induced several medical men of much sagacity and experience to doubt, and even with some positiveness to deny, that the patient was suffering under that disease at all. They supposed him to be hysterical, half-crazy, or on the brink of delirium tremens. But though slightly expressed, the symptoms were unlike anything I had ever witnessed, except in the previous instance. And the closing scene was quite distinctive.

It appeared, and he spoke of it as a thing which distressed him, that when he was most excited, his urine passed involuntarily.

In the evening I found his father with him. He had recognised him, and kissed his mother-in-law; but soon began to rave, and to be apparently occupied with absent persons. He was pale and weak, and lay with his head over the side of the bed, spitting continually upon the floor, which was thus made quite wet. He wished to have his hands at liberty that he might 'clear his mouth.' He was soliloquizing when I went into the room, in this way: 'Monsters—monsters—see that monster Susan—take her away.' (It appeared that he was now speaking of a young woman who had had a child by him.) 'I thought they would do much for science, but never supposed they would inflict such agony as this;' and so on.

A little later Mr. Arnott visited him. He had then no pulse at the wrist. The waistcoat was removed. He sat up, and used some water, brought to wash his hands, without apparent distress. Soon after he sank back exhausted; and expired.

His father corroborated what the patient had said of the dog; and told us that his son was clever, and better educated than many of his rank (he was a tailor), but always exceedingly nervous.

The body was examined the next day. Its posterior and undermost surface was very livid. The blood everywhere quite fluid. The veins of the spinal cord, on its posterior part, were turgid; not at all so on the anterior. The substance of the cord was quite natural. There was some fluid in the theca. The brain appeared to me, in every part, quite sound and healthy.

The head and face, which had been hanging over the table while the spinal canal was opened from behind, were deeply purple as though universally bruised. This colour diminished rapidly after the corpse was placed supine, and the head raised somewhat above the level of the body. The papillæ at the back part of the tongue were greatly exaggerated, and looked like large vesicles. The cartilage of the epiglottis, at its lower part, was red. At about the middle portion of the œsophagus there was an appearance as if the cuticle had been abraded. The mucous membrane of the stomach was soft, and red here and there, with a dotted injection resembling ecchymosis, especially on its rugæ. The air-passages were apparently healthy.

On the first day of the year 1855, a lady, 32 years old, residing at a short distance from London, was bitten on the ulnar side of the middle finger of her right hand, in the furrow between the skin and the nail, by a white cat, belonging to the stables of the house. The young lady's brother had seen the cat quarrelling with a terrier the day before; and afterwards struggling and fighting with another cat. Supposing that the animal might be ill, or hurt, the lady desired to have it brought to her, and placed it on her lap, when it bit her.

The cat was killed the same day, but not before it had scratched the gardener's child, flown furiously at another man, and seized and bitten a whip with which the coachman had attacked it.

On Wednesday, the 14th of March, Miss L. began to feel generally unwell. On the 16th, pain ran from the bitten finger along the ulnar aspect of the right arm into the axilla, and across the chest about the level of the fifth rib. No redness nor swelling was visible about the scar, but she spoke of a sensation there as if the skin were *thin*. This pain did not last long, nor did it recur.

On Saturday, the 17th, she found a difficulty in swallowing medicine. Dr. Todd visited her in the evening, with Dr. Garrett, and prescribed enemata, containing each ten drops of laudanum. Some puffiness in the right axilla was noticed, but it soon disappeared.

On Sunday morning I met those physicians in consultation. I found Miss L. in bed, with a wildish expression about her eyes. Her tongue was dry and furred; her pulse 80, soft, with occasional accelerations for a few beats only. There was a slight systolic murmur of the heart, which was beating noisily. Her bowels had acted during the night. She had twice passed urine into the bed, and she said that she had done so inevitably, and that 'it showed how weak she was.' The debility was indeed very great, as we perceived upon raising and sustaining her in a sitting position.

A morsel of ice was given to her. She put it hastily into her mouth, then drew back her head, and stretched out her arm with a repelling gesture, and sighed many times; but she failed to swallow the ice. Afterwards she succeeded better with some tea, which she took in spoonfuls, yet with a strange hurry, and with sighing gasps, and a rolling upwards of the eyes.

It was remarkable that this patient was not agitated, nor apparently distressed, by the sound of liquids poured from one vessel into another, nor by the access of light upon the sudden withdrawing of the window-blinds, nor by currents of air, for she even bore to be fanned.

I conclude that she knew, or at least suspected, what was the matter with her, for she said that to drink some tea would be a *test*.

She then, without much difficulty, ate a boiled egg; and under encouragement, and our expression of hopes that she was better, and exhortations to be careful and not to hurry, she swallowed, with seeming ease, a glass of wine in successive tea-spoonfuls—until the last spoonful, from which she recoiled with a look of terror, exclaiming, despondently, 'It is no better.'

We were to visit her again together the next day, though I had my misgivings as to her surviving the night. I learned from Dr. Garrett that she swallowed more wine in the afternoon, and fancied it did her harm. She had then paroxysms of sighing respiration, with intervals of comparative calm. At seven in the evening Dr. Garrett noticed that she began to eject, in a gulping manner, saliva and viscid mucus from her mouth. This increased in quantity, and was attended with a sort of chewing, or champing. At ten o'clock she desired that the servants should, one by one, be brought to her bed-side, and exhorted them severally to the observance of their religious duties. She expired at a quarter past seven o'clock on the

Monday morning, her mind having continued clear to the end.

The fourth case to which I have alluded was, in my judgment, a genuine instance of hydrophobia, although some, who witnessed it, doubted. I am indebted for the opportunity of seeing it to the kindness of Dr. Sibson, under whose care the patient, a female child five years of age, was lying in St. Mary's Hospital.

She had been bitten by a spaniel on the 3rd of May, in the right leg, just above the calf, where the scars of the injury were visible. The dog was killed the same afternoon. The child began to be unwell on the 4th of June. The symptoms reported were shudderings whenever a stream of wind passed over her, and spasms, and gasping dysphagia upon her attempting to drink. I saw her on the 9th of that month. Her countenance was tranquil, and now and then assumed a sort of idiotic smile. When a current of air was directed upon her by blowing, she made a sighing start, cried for a few seconds, and was again quiet. She took from a spoon some wine and beef-tea readily, and seemed to like them, for she opened her mouth always as she saw the spoon approach her lips. When the cup was offered her, she clutched it with her hands, and drank a little, with obvious distress. A mirror waved before her face did not appear to affect her. She had dozed a little in the night. Occasionally she closed her eyes, which could then be seen to quiver or vibrate beneath the shut lids. I thought she squinted slightly. She did not utter any articulate words, but she had talked a good deal the day before. She was very weak; unable to stand. Though I observed no mucus about her mouth, she was said to have spat out viscid frothy saliva, and frequently to have grinded her teeth. She particularly disliked to have her abdomen touched, or uncovered.

On repeating my visit to the hospital later in the day I found her weaker. She had voided urine into the bed, and had vomited several times. She made frequent little backward jerks of the head—which was held back rather rigidly by the muscles of the neck, while her shoulders were firmly hunched up. Swallowing could still be effected, but with increased difficulty. She was less sensible to currents of air. Her pulse was very rapid. Afterwards sickness and hiccup came on, and she died early the next morning.

A careful examination of the dead body disclosed nothing remarkable, or illustrative of the disorder. The symptoms had been attributed to worms; but the intestines were slit up through their whole length, and no worms were found.

Generally, the disease, when it has once set in, and shown the peculiar hydrophobic symptoms, runs a short and fierce course. The nervous irritability becomes extreme. The peculiar paroxysms of choking spasm, and sobbing, are excited, not only by attempts to swallow liquids, but by the very sight or sound of them. Dr. Elliotson mentions a boy who was thrown into a state of violent agitation by hearing a dresser who sat up with him make water. The passage of a gust of wind across his face, the waving of a polished surface, or of a mirror, before his eyes, the crawling of an insect over his skin, even the scent of a flower, is often sufficient to excite great irritation, and the peculiar strangling sensation about the fauces, in a hydrophobic patient. These circumstances were but little observable in the patients whose cases I have related. The first of them indeed was remarkably calm and tranquil under the disease. In general the patient is dreadfully irritable, apprehensive, and suspicious; and in most cases there is a degree of mania or delirium mixed up with the irritability; the sufferer is very garrulous and excited. In this respect there is a marked difference between hydrophobia and tetanus. In the latter disorder the mental faculties are clear, and the patients serene, and what is called heart-whole, to the last. The two diseases differ in another striking particular: the spasm in the one case is tonic, in the other clonic. In tetanus, again, there is no thirst, and seldom any accumulation of tough and stringy mucus in the fauces and about the angles of the mouth: in hydrophobia both these symptoms are always, I believe, present. So probably is vomiting; but vomiting in tetanus is rare. The nervous irritability in hydrophobia is doubtless a part of the disease, and is very seldom absent even now-a-days. Some time ago it might perhaps have been plausibly attributed to the treatment adopted. I allude to that period in which it was believed that these miserable persons had both the power, and the inclination, to impart the disease to others by biting them; and when, under pretence of shortening *his* sufferings, but really, I am afraid, with the cowardly view of protecting *themselves*, his friends were accustomed to smother the unhappy patient between two feather-beds, or to open a vein, and to leave him to bleed to death. Any person suspecting what was the matter, and foreseeing such a termination to his disease, might well be nervous and irritable. But now that this barbarous practice has been exploded, and the dread of being smothered does not occur to the mind of the patient, he is still found to be exquisitely irritable and timorous. The foam and sticky mucus that gather in the throat and mouth, these patients make great efforts, by spitting and blowing, to get rid of; and the sounds they thus produce have been exaggerated by ignorance and credulity into the barking and foaming of a dog. In the same way the paraplegia which sometimes takes place, rendering the patient unable to stand upright, has been misconstrued into a desire on his part to go on all fours like a dog. The pulse, though it may be strong and hard at the outset, becomes, in a short time, frequent and feeble, and the general strength declines with great rapidity. Death occasionally takes place within twenty-four hours after the commencement of the specific symptoms. Most commonly of all it happens on the second or third day; now and then it is postponed to the fifth day; and in still rarer instances, of which my first case was one, death does not occur till the seventh, or eighth, or ninth day. In most cases the paroxysms, becoming more violent and frequent, exhaust the patient; but occasionally the symptoms undergo a marked alteration before death. The paroxysms cease, the nervous irritability disappears, the patient is able to eat and drink and converse with ease; those sights and sounds which so annoyed and distressed him before, no longer cause him any disquiet. In this state he often sinks into a sleep, and suddenly wakes from it to die: sometimes his existence is put an end to by a sudden and violent convulsion.

It is needless for me to go into a minute account of the morbid appearances that have been met with in persons dead of hydrophobia. They are various, uncertain, unsatisfactory. Decomposition of the tissues, and of the blood, is said to take place rapidly. In some bodies the most careful examination has discovered nothing amiss. In others, vascularity of the brain, or of the spinal cord, has been noticed. And in not a few instances the mucous membrane of the fauces, œsophagus, and stomach—or of the larynx and trachea—or of both these tracts—has been found red, and covered with adhesive mucus. But we must take care not to attribute undue importance to these last appearances—not to conclude that they have been the cause of the symptoms, when, in truth, they may have been the effect of the disease. That we should find the parts about the throat red and congested is what we might naturally expect, when we consider the violent straining spasmodic action of these parts for some time before death. The morbid anatomy of this disease throws but little light upon its nature, or upon its proper treatment.

Many interesting questions present themselves relative to hydrophobia. I will state the principal of these as shortly as I can.

1. You will be surprised when I tell you that some persons have made it a question whether there is, or ever was, any such disease at all. I have known such. The late Sir Isaac Pennington, who was Regius Professor of Physic at Cambridge, had never seen a case of hydrophobia, and nothing could persuade him that anyone else had seen anything more than a nervous complaint produced by the alarmed imagination of the patient, who, having been bitten by a dog reputed to be mad, and having the fear of feather-beds before his eyes, was frightened into a belief that he had hydrophobia, and ultimately scared out of his very existence. Now if you meet with such incredulous persons, and think it worth your while to argue the point with them, you may object to their unbelief, the improbability that so many persons who have been bitten by mad dogs should have suffered so precisely the same train of symptoms, and at last have died, from the mere force of a morbid imagination. You may urge them with the fact that many of these persons have been under no apprehension at all until the disease has seized upon them; that many also have been men of naturally strong and firm minds, not at all likely to be frightened into believing that they were seriously ill unless they really were so, and still less likely to be terrified into their graves. And if this have no weight with such reasoners, you may bring forward the conclusive facts that the disease has befallen infants, and idiots, who had never heard or understood a word about mad dogs or hydrophobia, and in whom the imagination could have had no power in calling forth the complaint. And if they are proof against this, you must give them up: I can suggest nothing more.

2. Allowing that the disease exists as a real, and not merely imaginary disease, and also that it is caused by the bite of a rabid animal: this important question arises—has it any *other* cause?

Setting aside that quibbling application of the term hydrophobia, which some writers have chosen to make, to diseases in which, from some painful affection of the throat, the patients have been unwilling to attempt to swallow fluids, there are cases recorded, exactly resembling hydrophobia in their symptoms, and occurring in persons who were never known to have been bitten by, or even to have been in the presence of, a rabid animal. The celebrated and accurate Pinel has given the history of such a case. There is another by Savirotte, in the 'Journal des Savans' (August, 1757). Now it is just possible that this disease may sometimes develope itself in the human body without any contagion having been applied; and it is also possible, and much more probable in my judgment, that the poison may have been applied without the person's being aware of it. We shall see, by and by, some very curious ways in which that might happen. All that we need concern ourselves with practically, is this—that in 999 cases out of 1000 the disease in the human body is derived from a rabid animal. If it ever be spontaneous, we cannot reckon upon meeting with such a case: indeed, many medical men pass through life without witnessing the disorder at all.

3. Granting, then, that the disease in man is the result of an animal poison, the next question is, from what animals he may receive the infection?

We are sure that the disease, by the inoculation of which hydrophobia may be produced in man, is common in the *dog*, and that it has been communicated to the human animal by the fox also, the wolf, the jackal, the racoon, and the cat. Mr. Youatt says that the saliva of the badger, the horse, the human being, have undoubtedly produced rabies, and some affirm that it has been propagated even by the hen and the duck. The same author mentions a case in which a groom became affected with hydrophobia through a scratch which he received from the tooth of a horse that was labouring under the disease. All animals, even fowls, are susceptible of the disorder when bitten by the rabid dog. Of course it is an important question to have resolved, whether the saliva of all these is capable of conveying the malady. The case just now mentioned on Mr. Youatt's authority would seem to settle the question as respects the horse; but as horses, cows, turkeys and other fowls, do not usually bite, we have not many opportunities of supplying a positive answer to the general question: there can be no doubt about the *cat*, the *fox*, the *wolf*, and the *jackal*.

The late Duke of Richmond died in Canada of hydrophobia, communicated, it was thought, by a tame fox.* In the 13th volume of the 'Medico-Chirurgical Transactions,' an account is given by Mr. Hewitt, of several cases of fatal hydrophobia from the bite of a wild and rabid jackal. Many examples are on record of the production of the disease by the bites of mad cats and wolves.

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* A lady, who had read this, was good enough, in 1862, to inform me, upon the authority of a friend of hers, who was living at Montreal at the time of

The first case which I have spoken of, as having been seen by myself, would seem to prove, if all the facts were correctly stated at the time, that the saliva of the dog may be sufficient to produce the disease, when it is merely applied to the unbroken skin. It was affirmed by various persons that the teeth of the terrier did not break the cuticle. But we must take care not to draw a hasty general inference from a single instance. The late Mr. Youatt, who had seen more of the disease probably both in man and in other animals, than any other person in this country, did not think that the saliva of a rabid animal could communicate the disorder through the unbroken cuticle: he believed that there must be some abrasion or breach of surface. He held, however, that it might be communicated by mere contact with the mucous membranes.

Of its harmlessness on the sound integument, he offered this presumptive evidence—that his own hands had many times, with perfect impunity, been covered with the saliva of the mad dog. He records some singular instances in which the disease was transmitted by contact of the saliva with the mucous membranes. 'A man endeavoured to untie with his teeth a knot that had been firmly drawn in a cord. Eight weeks afterwards he expired, undeniably rabid. It was then recollected that with this cord a mad dog had been confined. A woman was attacked by a rabid dog, and escaped with the laceration of her gown. In the act of mending it she thoughtlessly pressed down the seam with her teeth. She died.' If these cases be authentic, they are conclusive of this question; unless, indeed, the lips of those who perished happened to have been chapped or abraded. But Mr. Youatt's own opinion was that the virus could not be received on a mucous surface without imminent danger.

The disease is said to have been caused by the *scratch* of a

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the Duke's death, and acquainted with his family, that his disease was caused by the bite of a *dog*. And I have since been told by Mr. Lawrence Peel, the Duke's son-in-law, that it was uncertain whether the bite was made by a fox or by a dog; that the Duke was interfering in a fray between a tame fox and a pet dog—the fox retreating into his kennel. It is not accurately known which, or whether either, of the animals had rabies.

cat. But as we know that cats as well as dogs frequently apply their paws to their mouths, especially when the latter part is uneasy, (as it clearly is in mad dogs,) this fact of the production of the disease by a scratch, if thoroughly made out, would not *prove* that the disease can be introduced into the system in any other way than by means of the saliva.

LECTURE XXIX.

Hydrophobia, concluded. Various Questions considered respecting the Disease as it appears in the Human Subject, and respecting Rabies in the Dog. Pathology of the Disorder. Treatment. Preventive Measures.

After giving you some account of the phenomena of *hydrophobia*, or *rabies canina*, I began to notice, in the last lecture, the chief of the interesting questions which naturally present themselves to the minds of most men, and especially of medical men, in respect of that shocking disorder.

In the first place, there *is* such a disorder. It appears, too, secondly, from statements made upon credible authority, that the same group and succession of symptoms as characterise the disease when it follows the bite of a rabid animal, have been observed to occur in persons who were never known to have been bitten. In my own opinion it is more probable that these persons had been exposed to the virus without being aware of it, than that the disease was spontaneously engendered in their bodies. I would make the same remark with regard to an instance which is said to have happened of hydrophobia in a lad who had been bitten five weeks before by a *healthy* dog: the dog remaining well at the time of his seizure and death. Mr. Youatt holds, indeed, that however the disease originated, it never occurs now, not even in the dog, except as a consequence of the application of the specific contagion. It is certain, in the third place, that (besides the dog) the wolf, the fox, the jackal, and the cat, have communicated the disorder to the human animal. The death from hydrophobia of a boy after being bitten by a racoon, is recorded by Dr. Russel, of Lincoln, Massachusetts, in a report contained in the 'Transactions of the American Medical Association for 1856.' Mr. Youatt affirms, in his pamphlet on this disorder, that the saliva of the badger, of the horse, and of the human being, has caused rabies; and I mentioned, on his authority, a case in which a groom contracted the disease through a scratch which he received while administering a ball to a rabid horse. But I feel much less certain about these latter animals. Respecting the dog, the fox, the wolf, the jackal, the cat, there can be no question. The result of certain experiments made at the Veterinary School, at Alfort, is opposed to Mr. Youatt's statement. Professor Dupuy made wounds in cows and sheep, and rubbed upon these wounds sponges which had been chewed by rabid animals of the same species: yet he never succeeded in communicating the disorder in this way; but when he used a sponge that had been mumbled by a mad dog, then the disease occurred in the sheep and cows.

It is still more interesting to enquire, whether the saliva of a human being, labouring under hydrophobia, be capable of inoculating another human being with the same complaint? Mr. Youatt says, yes: that the disease has undoubtedly been so produced. If this be so, the fact will teach us—not to desert or neglect these unhappy patients, still less to murder them by smothering—but to minister to their wants with certain precautions: so as not to suffer their saliva to come in contact with any sore or abraded surface; nor, if it can be avoided, with any mucous surface. On the other hand, all carefulness of that kind will be unnecessary, if the disease cannot be propagated by the human saliva. Certainly many experimenters have tried in vain to inoculate dogs with the spittle of a hydrophobic man; but there is one authentic experiment on record, which makes it too probable that the disease, though it may not be communi*cated* often, or easily, is yet communi*cable.* The experiment is said to have been made by MM. Magendie and Breschet, at the Hôtel-Dieu, and to have been witnessed by a great number of medical men and students. Two healthy dogs were inoculated on the 19th of June, 1813, with the saliva of a patient, named Surlu, who died of hydrophobia the same day in that hospital. One of these dogs became mad on the 27th of the following month. They caused this dog to bite others, which, in their turn, became rabid also: and in this way they propagated the malady, among dogs, during the whole summer. Now this is a very striking fact, yet it ought not to be considered conclusive: for it is possible that the dog might have gone mad at that time, whether he had been so inoculated, or not. It may have been a mere coincidence. We want repetitions of such experiments to *settle* the point: nevertheless, we have enough in this one experiment to make us use all necessary caution when engaged in attending upon a hydrophobic patient.

I just touched upon the question, whether the saliva of a rabid dog could produce the disease if it fell upon the *sound* *skin?* The first of the cases which I related as having been witnessed by myself, would appear to give an affirmative answer to this question. Mr. Youatt thinks the disease would *not* follow such an application of the virus; but that it cannot be received upon even the unbroken surface of a mucous membrane without the greatest danger. Horses are said to have died mad after eating straw upon which rabid pigs had died. Portal was assured that two dogs, which had licked the mouth of another dog that was rabid, were attacked with rabies seven or eight days afterwards. Mr. Gilman, of Highgate, in a little pamphlet on Hydrophobia, quotes an instance from Dr. Percival, in which a mad dog licked the face of a sleeping man, near his mouth, and the man died of hydrophobia, although the strictest search failed to discover the smallest scratch or abrasion on any part of his skin.

At the very close of the lecture I observed, that even should it be clearly proved that hydrophobia has ever resulted from the scratch of a rabid animal's *claws*—the claws of a cat, for example—we are not to set it down as a sure thing that the disease can be introduced into the system independently of the saliva of the diseased animal. As we know that dogs and cats are in the habit of putting their paws to their mouths when they feel uneasy there, we may readily understand how the poisonous saliva may be introduced by a mere scratch with the creature's nails. Mr. Youatt believes that the saliva *only* is capable of conveying the disease.

4. Supposing the virus to have been inserted into the part bitten, what becomes of it? Is it immediately taken into the system, and does it, like the poison of small-pox, in some mysterious way, multiply and diffuse or mature itself within the body, until the disease explodes? Or does it remain imprisoned in the wound, or in the cicatrix, for a time? This is an important practical question. For if the poison lurk for some weeks in the place where it was originally deposited, we might successfully remove it at any time between the infliction of the bite and the period of recrudescence. Now the facts, that at this period of recrudescence the wound or scar is re-inflamed often, and almost always becomes the seat of some fresh morbid phenomena, pain, swelling, numbness, and the like, spreading towards the trunk—and that, *soon after this*, the peculiar paroxysmal symptoms begin—these facts are strong in favour of the belief that the poison may lie inert in the place of the original hurt, for some time. Sir James Bardsley states

that the recrudescent pains seem always to follow the course of the nerves, and do certainly never inflame or irritate the lymphatic glands in the vicinity, though passing in a parallel course towards the trunk. He affirms the entire absence of any fact contrary to this observation in the works of the numerous authors who have written on the subject. I mention this statement, because it certainly is not correct. Mr. Mayo says, 'in one case, which I witnessed and examined after death, the inner part of the cicatrix was bloodshot; and a gland in the axilla had swelled at the coming on of hydrophobic symptoms.' And I find among my notes of Mr. Abernethy's lectures, another striking case, still more to the point. 'A very intelligent boy had been bitten by a dog in the finger: he was brought into St. Bartholomew's Hospital. Caustic had been liberally used, affecting the sinewy parts, and producing a terrible sore: yet the boy was recovering himself, and the sore was healing. One day, as Mr. Abernethy was going round the hospital, he saw and spoke to the boy, who said he thought himself getting well, but that he had that day an odd sensation in his fingers, stretching upwards into his hand and arm. Going up the arm, Mr. Abernethy saw two red lines, like inflamed absorbents: they doubtless were so. He affected to make light of the matter, ordered a poultice, and recommended the boy to take some medicine. Early the next morning Mr. Abernethy visited the ward, pretending he had some other patient there, whom he wished particularly to see: and when going out again, he asked the boy, in a careless tone, how he was. He said that he had lost the pain, but that he was very unwell, and had not slept all night. Mr. Abernethy felt his pulse, told him he was a little feverish, as might be expected, and asked him if he were not thirsty, and would like some toast and water. The boy said he *was* thirsty, and that he *should* like some drink: when, however, the cup was brought, he pushed it from him; he could not drink. In forty-eight hours he was dead.'

Facts such as these would lead to the conclusion that, in cases in which excision had not been performed in the first instance, the scar, or the sore, might be cut out with propriety at any time before the period of recrudescence: and if the case happened to be my own, I would have this done even *at* that period, the moment any new sensation manifested itself in the seat of the injury. Mr. Mayo, on the same grounds, advocates the removal of the cicatrix, even although the hydrophobic symptoms may have appeared. I do not mean to say that the facts, now referred to, show with any certainty that the poison remains in the place where it was first deposited until the phenomena of recrudescence take place: but they afford a strong presumption in favour of that notion: and in such a disease as hydrophobia, we are bound to act upon the very lowest presumption that affords a chance for our patient's life. The poison may be absorbed into the general system at the period of recrudescence, although no affection of the absorbing vessels or glands should be manifest: through the veins, namely.

Poisons that find entrance into the blood do not remain inoperative there for an indefinite time, and then begin to manifest their poisonous influence. They lodge in this organ or in that, and presently disturb its functions: or they are, more or less rapidly, eliminated from the body through one or more of its natural emunctories: or they produce specific and constant results after periods of incubation, which are also definite and constant—as we see in cases of small-pox and measles. But there is no instance known that I am aware of (unless indeed it be so in this disease of hydrophobia) in which a poison circulates in the blood for an indefinite and long period, to give rise at last to symptoms that are strictly specific. Looking at the matter theoretically or practically, I should recommend, under the circumstances already stated, the excision of the cicatrix. The poison of hydrophobia may be shut up in a nodule of lymph, or detained in temporary and precarious union with some one of the animal tissues, just as I shall hereafter show you the poison of lead may be.

This view of the matter may help to explain the great difference which has been observed in different cases in the period intervening between the bite, and the outbreak of the disease; and even perhaps the total exemption from the disease of some of the bitten persons. In one instance, which was treated in Guy's Hospital, and the particulars of which were carefully investigated by Dr. Gull, the disorder broke out more than five years after the patient had been bitten by a pointer bitch just below his left knee. There a cicatrix was visible, and the hydrophobic attack was preceded by pain in that part. In the first volume of the 'Lancet' the case is recorded, by Mr. Hale Thompson, of a lad who died of hydrophobia seven years after a bite by a dog on the right hip, where there remained a scar: for twenty-five months before his death, this patient had been in close confinement in prison, and out of the way of dogs altogether. Analogous facts, corroborative of the hypothesis which I have been suggesting, have been noticed in regard to another animal poison, the vaccine virus. The following curious statement is quoted by Mr. Grove, in the 'Monthly Journal of Medical Science' for November 1853. 'A girl, aged 14 years, was seized with influenza. She complained of pain in each arm at the spots where, when an infant, she had been vaccinated; and in fact, in these places, vaccine vesicles now became perfectly developed. An elder sister was re-vaccinated with the lymph hence obtained; beautiful vesicles formed, and ran a normal course.' At the Obstetrical Society of London in 1860, Dr. Hodges stated that 'in May 1854 he vaccinated a little boy 3 years of age, but the arm did not rise within the usual period. In the following May, however, a vesicle spontaneously formed, with an areola on the seventh and eighth days, gradually declining on the eleventh and twelfth; a permanent cicatrix, marked by pits, remaining, giving evidence of the genuine vaccine disease.'

5. Another important question is this. Is a man who has been bitten by a mad dog, and in whose case no precautions have been taken, a doomed man? will he be sure to have the disease, and therefore to die of it? By no means. But few, upon the whole, of those who are so bitten, become affected with hydrophobia.

It is curious that different species of animals appear to be susceptible of hydrophobia in different degrees. Thus, according to Mr. Youatt, two dogs out of three, bitten by one that is rabid, become rabid. The majority of horses inoculated with the virus, perish. Cattle have a better chance: perhaps because in them the skin is looser and less easily penetrated. A full half (he thinks) of those that were seized by a mad dog, would escape. With sheep the bite is still less dangerous. He reckons that not more than one in three would be affected. The tooth, perhaps, has been wiped clean in its passage through the wool. The human being is least of all in danger. John Hunter states that he knew an instance in which, of twenty-one persons bitten, one alone fell a victim to hydrophobia. Dr. Hamilton estimates the proportion to be one in twenty-five. But I fear these computations are much too low. In 1780, a mad dog, in the neighbourhood of Senlis, took his course within a small circle, and bit fifteen persons before he was killed: three of these died of hydrophobia. The saliva of a rabid wolf would seem to be highly virulent and effective. These beasts fly always, I believe, at a naked part. Hence, probably, the fatality of their bites. The following statement applies exclusively to the wolf. In December, 1774, twenty persons were bitten in the neighbourhood of Troyes; nine of them died. Of seventeen persons similarly bitten in 1784, near Brive, ten died rabid. In May, 1817, twenty-three persons were bitten and fourteen perished. Four died out of eleven that were bitten near Dijon: and eighteen of twenty-four bitten near Rochelle. At Bar-sur-Ornain, nineteen were bitten, of whom twelve died of hydrophobia within two months. Here we have one hundred and fourteen persons bitten by rabid wolves, and among them no less than sixty-seven victims; considerably more than one-half. There is no doubt, however, that the majority of persons who are bitten by a mad dog escape the disease. This may partly be owing to an inherent inaptitude for accepting it. We see some persons who, though often in the way of it, do not contract syphilis; there are others upon whom the contagion of small-pox has no influence. This difference exists, apparently, even among dogs. There was one dog, at Charenton, that did not become rabid after being bitten by a rabid dog; and it was so managed that, at different times, he was bitten by thirty different mad dogs; but he outlived it all. Much will depend also upon the circumstances and manner in which the bite is inflicted. If it be made through clothes, and especially through thick woollen garments, or through leather, the saliva may be wiped clean away from the tooth before it reaches the flesh. In the fifth volume of the 'Edinburgh Medical and Surgical Journal,' there is a case described by Mr. Oldknow, of Nottingham, in which a man was bitten in three different places by the same dog, viz.—in the scrotum, the thigh, and the left hand; the bite on the hand was the last. Now it seems not improbable that but for this last bite, on a naked part, he might have escaped. At least it was a remarkable circumstance that the phenomena of recrudescence occurred only in the hand and arm. The dog is supposed to have closed his mouth after inflicting the first two bites, and thus to have charged his teeth afresh with the poisonous saliva. In the American report, to which I just now referred, it is stated, that of seventy-five cases, the injury was inflicted on the hand in forty instances, on the face in fifteen, on the leg in eleven, on the arm in nine.

It is this frequent immunity from the disease in persons who have been bitten, that has tended to confer reputation upon so many vaunted methods of prevention. Ignorant persons, and knavish persons, have not failed to take advantage of this. They announce that they are in possession of some secret remedy which will prevent the virus from operating: they persuade the friends of those who die that the remedy was not rightly employed, or not resorted to sufficiently early: and they persuade those who escape that they escape by virtue of the preventive remedy. If the plunder they reap from the foolish and the frightened were all, this would be of less consequence; but unfortunately the hope of security without undergoing a painful operation leads many to neglect the only sure mode of obtaining safety.

Mr. Youatt is of opinion that the power of the virus ceases with the life of the animal. He states, that in many dissections of the dog, the saliva, in spite of all care, must have come in abundant contact with his hands, and they were not always sound. I should strongly recommend you not to act upon this opinion: but to use the same precautions, in dissecting a rabid animal, as you would use if you were persuaded that the disease might be communicated with equal certainty before and after the death of the animal.

6. A still more anxious enquiry next arises. Whoever has been bitten by a rabid, or a suspected animal, must be considered, and will generally consider himself, as being in more or less danger of hydrophobia. This dread is not entirely removed, even by the adoption of the best means of prevention. Now, how long does this state of hazard continue? When is the peril fairly over? After what period may the person who has received the injury lay aside all apprehension of the disease? To this enquiry no satisfactory reply can be given. In a vast majority of instances, indeed, the disorder has broken out *within two months* from the infliction of the bite. But the exceptions to this rule are too numerous to permit us to put firm trust in the immunity afforded by that interval. Cases are recorded in which five, six, eleven, nineteen months, have intervened, between the insertion of the poison and the eruption of the consequent malady. Nay, there are well-authenticated instances, as I have just told you, of the lapse of twenty-five months, of more than five years, and even of seven years. In more or fewer of these cases one cannot help fancying that some unsuspected re-inoculation, some fresh application of the peculiar virus, may have taken place. If not, then we must conclude that the poison really lies imprisoned in the part; and only becomes destructive when, under certain obscure

conditions, and at indefinite periods, it is set afloat in the circulating blood. The shortest intervening period that I have found recorded is three or four days, the longest twelve years: according to Romberg, the average period is from four to seven weeks.

It is interesting to know that a similar uncertainty of access has been noticed among infected *dogs*. On the night of the 8th of June, 1791, the man in charge of Lord Fitzwilliam's kennel was much disturbed by fightings among the hounds; and got up several times to quiet them. On each occasion he found the same dog quarrelling; at last, therefore, he shut that dog up by himself, and then there was no further disturbance. On the third day afterwards, the quarrelsome hound became unequivocally rabid; and on the fifth day he died. The whole pack were thereupon separately confined, and watched. Six of the dogs became subsequently mad; and at the following widely different intervals from the 8th of June, viz.—23 days, 56, 67, 88, 155, and 183 days.

Rabies occurs vastly more often in dogs, than in bitches. Professor Coleman, in his evidence taken before a committee of the House of Commons on this subject, states that when the disorder finds its way into a kennel of foxhounds, the mad dogs bite the dogs, but spare the bitches. Among 392 collected instances, 356 dogs were bitten, and 36 bitches; the ratio being almost exactly that of 10 to 1.

There are some considerations respecting this disease, which relate to both the biter and the bitten; the canine and the human being. And there are some which relate exclusively to the dog, yet concerning which we, as medical philosophers, ought not to be ignorant. I shall advert to a few of these.

One question I have already glanced at; viz., whether the disease may be produced by a healthy, though angry dog or cat. I referred to one instance in which this was supposed to have been the case; and I repeat that I should be more inclined to think, unless we had other examples of the same kind, that the person had been inoculated in some way that he was not aware of. But I have heard Mr. Youatt describe cases in which there had been no symptoms of rabies observed in the dog at the time the injury was inflicted, though soon afterwards the animal became decidedly rabid. It is much to be regretted that the dog is so often destroyed. When a person has been bitten by a dog or cat suspected to be rabid, the beast should never be killed, but secured, and kept under surveillance, and suffered, if it shall so happen, to die of the disease. If he do not die, in other words, if he be really not rabid, that will soon appear; and the mind of the patient will then be relieved from a very painful state of suspense and uncertainty, which might otherwise have haunted him for months or years. Should the dog die mad, the injured person will be no worse off than if the animal had been killed in the first instance: nay, in one respect he will be better off, inasmuch as certainty of evil is preferable to perpetual and uneasy doubt. 'Give a dog a bad name (says the proverb), and hang him:' and it is literally so with the imputation of madness. A wretched dog is perhaps ill, or weary, or cross, or he may have been worried already by mischievous boys: the cry of mad dog is raised; and then he must expect no mercy. There are gross errors prevalent with regard to the signs of madness in the dog. If a dog be seen in a fit in the street, some person charitably offers a conjecture that perhaps he may be mad; the next person has no doubt about it; and then, woe to that dog! But Mr. Youatt assures us that the rabid dog never has fits: that the existence of epilepsy is a clear proof that there is no rabies. Again, it is a very common belief that a rabid dog, like a hydrophobic man, will shun water; and if he take to a river, that is thought to be conclusive evidence against his being mad. But the truth is, that the disease, in the quadruped, cannot be called *hydrophobia*: there is no dread of water, but an unquenchable thirst; no spasm attending the effort to swallow, but sometimes in dogs an inability to swallow, from paralysis of the muscles about the jaws and throat. They will stand lap, lapping, without getting any of the liquid down. They fly eagerly to the water; and Mr. Youatt states that all other quadrupeds, with perhaps an occasional exception in the horse, drink with ease, and with increased avidity. This erroneous impression is not confined to the vulgar. In the case which I have more than once alluded to, and which is mentioned in Hufeland's Journal, of a lad who died of hydrophobia after having been bitten by a dog that had not been and was not then mad, one circumstance stated in evidence of the animal's freedom from rabies is, that he drank without difficulty a large quantity of water.

There is another superstitious opinion not at all uncommon, viz.—that healthy dogs recognise one that is mad, and fear him, and run away from his presence, in obedience to some mysterious and wonderful instinct, warning them of danger.

This is quite unfounded. Equally mistaken are the notions that the mad dog exhales a peculiar and offensive smell, and that he may be known by his running with his tail between his legs; except, as Mr. Youatt says, when, weary and exhausted, he is seeking his home.

It will not be out of place to state what *are* the symptoms of rabies as observed in the dog, and as described by Mr. Youatt.

The earliest symptoms of madness in the dog (he says), are sullenness, fidgettiness, continual shifting of posture, a stedfast gaze expressive of suspicion, an earnest licking of some part, on which a scar may generally be found. If the ear be the affected part, the dog is incessantly and violently scratching it. If it be the foot, he gnaws it till the integuments are destroyed.

Occasional vomiting and a depraved appetite are very early noticeable. The dog will pick up and swallow bits of thread or silk from the carpet, hair, straw, even dung: and frequently he will lap his own urine, and devour his own excrement. Then the animal becomes irascible; flies fiercely at strangers; is impatient of correction; seizes the whip or stick; quarrels with his own companions; eagerly hunts and worries cats; demolishes his bed; and if chained up, makes violent efforts to escape, tearing his kennel to pieces with his teeth. If he be at large he usually attacks only those dogs that come in his way; but if he be naturally ferocious he will diligently and perseveringly seek his enemy. According to Mr. Youatt, the disease is principally produced by the fighting dog in towns; and by the cur or lurcher in the country: by those dogs, therefore, which minister to the vices of the lower classes in town and country respectively. He maintains that if a well-enforced quarantine could be established, and every dog in the kingdom confined separately for seven months, the disease might be extirpated. This opinion is founded of course upon the belief that rabies never originates at present, any more than small-pox does, *spontaneously*; but is always propagated by the specific virus. And it is corroborated by the fact that rabies and hydrophobia are unknown in some countries: in the Isle of Cyprus, for example, and in Egypt. I fancy that South America is, or was, a stranger to it. It appears to have been imported into Jamaica, after that island had enjoyed an immunity from the disease for at least fifty years previously; and Dr. Heineken states that curs of the most wretched description abound in the island of Madeira; that they are afflicted with almost every disease, tormented by flies, and heat, and thirst, and famine, yet no rabid dog was ever seen there. I have been told by Sir Henry Young that in Tasmania, of which he was for seven years the Governor, though there are plenty of dogs, there have been, as yet, no *mad* dogs, and therefore no hydrophobia. On the other hand, 1,666 deaths from hydrophobia, in the human subject, are stated to have occurred in Prussia in the space of ten years.

Very early in the disease, as it appears in the dog, the expression of countenance is remarkably changed; the eyes glisten, and there is slight strabismus. Twitchings of the face come on. About the second day a considerable discharge of saliva commences; but this does not continue more than ten or twelve hours, and is succeeded by insatiable thirst: the dog is incessantly drinking, or attempting to drink: he plunges his muzzle into the water. When the flow of saliva has ceased he appears to be annoyed by some viscid matter in his fauces; and in the most eager and extraordinary manner he works with his paws at the corners of his mouth to get rid of it: and while thus employed he frequently loses his balance and rolls over.

A loss of power over the voluntary muscles is next observed. It begins with the lower jaw, which hangs down, and the mouth is partially open; but by a sudden effort the dog can sometimes close it, though occasionally the paralysis is complete. The tongue is affected in a less degree. The dog is able to use it in the act of lapping: but the mouth is not sufficiently closed to retain the water. Therefore, while he hangs over the fluid, eagerly lapping for several minutes, it is very little or not at all diminished. The paralysis often attacks the loins and extremities also. The animal staggers about, and frequently falls. Previously to this he is in almost incessant action. Mr. Youatt fancies that the dog is subject to what we call spectral illusions. He says he starts up and gazes eagerly at some real or imaginary object. He appears to be tracing the path of something floating around him, or he fixes his eye intently upon some spot in the wall, and suddenly plunges at it; then his eyes close, and his head droops.

Frequently, with his head erect, the dog utters a short and very peculiar howl: or if he bark, it is in a hoarse inward sound, altogether dissimilar from his usual tone, and generally terminating with this characteristic howl. Respiration is always affected; often the breathing is very laborious; and the *inspiration* is attended with a very singular grating, choking noise. On the fourth, fifth, or sixth day of the disease, he dies: occasionally in slight convulsions; but oftener without a struggle.

Mr. Youatt gives a detailed account of the appearances met with after death in the carcasses of these rabid dogs. They are not very constant or distinctive. The most curious and uniform consist in the presence of unnatural ingesta in the stomach: straw, hay, horse-dung, earth. Sometimes the stomach is perfectly distended with these substances; and when it contains none of them, there is a fluid of the deepest chocolate colour mixed with olive; or still darker, like coffee: and when neither the unnatural ingesta nor the dark fluid appear, it will be found, Mr. Youatt says, upon careful enquiry, that the dog has vomited much hair, hay, straw, or the like.

In 1837, a few days after the case of hydrophobia occurred in the Middlesex Hospital, I saw the carcass of a dog, that had died rabid, examined by Mr. Ainslie at his and Mr. Youatt's Infirmary. The most remarkable morbid appearances were in the stomach, which contained some bits of straw and stick, and a considerable quantity of a dark fluid like thin treacle. In various parts of the stomach there were spots, almost black, of considerable size; apparently produced by dark blood partly extravasated beneath, and partly incorporated with, the mucous membrane.

I believe that Mr. Youatt's opinion, already mentioned, of the cause of rabies in dogs, and in all creatures—viz., that it always results from the introduction of a specific virus into the system—I believe that this opinion is not commonly entertained. Most people think that the disease is generated, *de novo*, in the dog at least; and causes have been assigned for it which certainly are not the true or the sole causes. Thus hydrophobia in the dog has been ascribed to extreme heat of the weather. It is thought by many to be particularly likely to occur in the dog-days; and to be, as Mr. Mayo observes, 'a sort of dog-lunacy, having the same relation to Sirius that insanity has to the moon: which, indeed, in another sense, is probably true.' Many cautions are annually put forth, about that season, for muzzling dogs, and so on: very good and proper advice, but, if those who have noted the statistics of the disease may be depended upon, it would be as appropriate at one period of the year as at another. Rabies occurs nearly as often in the spring, in the autumn, and even in winter, as it does in summer. M. Trolliet, who has written an interesting essay on rabies, states that January, which is the coldest, and August, which is the hottest month in the year, are the very months which furnish the fewest examples of the disease. The disorder has often been ascribed to want of water in hot weather, and sometimes to want of food. But MM. Dupuytren, Breschet, and Magendie, have caused both dogs and cats to perish with hunger and thirst, without producing the smallest approach to a state of rabies. At the Veterinary School at Alfort, three dogs were subjected to some very cruel but decisive experiments. It was during the heat of summer, and they were all chained in the full blaze of the sun. To one salted meat was given; to the second water only; and to the third neither food nor drink. They all died; but none of them became rabid. Nor does the supposition that the disorder has some connection with the period of sexual heat in these animals appear to have any better foundation.

If you are desirous of knowing what my own opinion on this matter is, I must say that I think Mr. Youatt's doctrine by far the most probable one; that rabies never occurs except from inoculation of the specific virus. It has not been proved, and indeed it would scarcely be susceptible of proof, that the disease ever breaks out spontaneously; large tracts of country are totally free from it; and in nineteen cases out of twenty, perhaps, we trace the bite or the fray in which the inoculation has been effected.

If I were asked to define the seat of this terrible disease, I should place it, without hesitation, in that division of the nervous system which comprises the excito-motory apparatus; the true spinal marrow, with its appendages of afferent and efferent nerves. Nay, I should go further, and say that it is the upper part of this apparatus, of which the functions are primarily and chiefly deranged: that the poison acts mainly upon the nervous arcs which pertain to the throat, and with which the eighth pair of nerves in particular is connected. There is nothing singular in this localisation of the influence of a specific poison. The ergot of rye affects principally those arcs which belong to the uterus; cantharides those which govern the muscular fibres of the bladder. It is true that the mental functions are remarkably modified, and that paralysis of the lower extremities occurs, in most instances of the disease. But neither of these phenomena is constant; and they simply illustrate, when they do happen, the facility with which any morbid state of the spinal cord may propagate its influence in either direction. Whether in hydrophobia the essential change be centric or eccentric, cannot be determined with anything like certainty: but it seems to me to be most probable that the sensibility of the afferent nerves of the fauces, of the skin, and of the air-passages, is altered or morbidly exalted; whence, upon the application of the exciting stimulus, the peculiar sighing dyspnœa, and the strangling dysphagia, are produced by a reflected influence through the central axis upon the muscles concerned in these actions. But, as I said before, the pathology of the excito-motory apparatus is as yet in its new birth.

What can I say of the *treatment* in hydrophobia; or in rabies? There is no well-authenticated case on record, that I am aware of, in which a hydrophobic person has recovered. As it has been, so it is still, Ιατρος ἰᾶται θανατος. The physician that cures is death. There can be no ground therefore for the *recommendation* of any especial drug, or form of medicine, nor even for any general plan of treatment, after the peculiar symptoms of the disease have once set in.

Of course those powerful remedial agencies that are in common use among medical men, have been fully tried: copious blood-letting, mercury to salivation, opium, arsenic, sugar of lead, oil of turpentine, the cold affusion even: and not only those, but the strong poisons that are sometimes but not so generally employed for other diseases: belladonna, stramonium, prussic acid, white hellebore, strychnia, cantharides, the inhalation of the nitrous oxide gas and of chloroform: and no end of less gigantic remedies; such as alkalies, and especially ammonia, carbonate of iron, electricity and galvanism, tobacco-juice, and the guaco (which was introduced into this country a few years ago with high encomiums for its power over the disease), the mineral acids, and violent exercise: and if we take into account the substances administered likewise to the brute, we may increase this list by the alisma plantago, scutellaria, box, and rue, all of which, at one time or another, have been vaunted as successful remedies; veratrum sabadilla also, ticunas poison, and the venom of snakes. Six vipers at once were allowed to inflict their bites on one of the victims of hydrophobia: with no good result.

The difficulty of swallowing fluids, and in some cases of swallowing at all, has been a serious hindrance to the fair trial of almost every form of internal remedy. But that difficulty vanished with the invention of the hypodermic method of cure: and the inoculation of a hydrophobic patient in this way, with some of the most potent of our remedial poisons, would still, in my opinion, be a justifiable and commendable expedient. At all events, under absolute hopelessness of cure, some one of the salts of morphia should be so inserted, to allay, if possible, the dreadful nervous distress of the dying sufferer.

When I last addressed you on this subject I ventured to predict that the vapour of chloroform would be tried, and tried in vain, in this untractable malady. I can now inform you that it has been tried, and found as useless, except for the purposes of quieting fierce excitement, and of promoting the euthanasia, as every other remedial measure.

Mr. Mayo suggested bronchotomy: upon this ground (to use his own words), 'that the principal character of the disease, and the rapid exhaustion which attends it, appear to depend in great part upon the fits of spasm and closure of the glottis, brought on, not merely by the attempt or the idea of drinking, but by any sudden impression upon the senses. Now it is clear (he adds) that as far as the distressing feelings in the throat consist in a sense of suffocation, they would be put an end to or relieved by the establishment of a free opening in the windpipe.' Dr. Marshall Hall would use, in combination with tracheotomy, the hydrocyanic acid. Now I must say that I should not beforehand have expected the smallest advantage from tracheotomy in this disease. The mode of death offers no encouragement to its use. There may be spasm of the glottis, but I doubt it. At any rate the patients do not die of suffocation. The death is not by apnœa, but by asthenia. We see persons labouring grievously for their breath for hours together, who yet survive, and are presently themselves again; persons, for instance, who are affected with severe spasmodic asthma. I have seen a man sitting up in bed a whole night long, inspiring with such difficulty that, if I had not been aware of his having, scores of times, been as bad before, I should have thought he could not exist five minutes longer. Now we have nothing of this dyspnœa in hydrophobia: and I see no hope of cure, nor even of sufficient benefit to counterbalance the inconvenience and hazard of the operation, from the performance of bronchotomy. The principle is that of suffering the parts gradually to recover themselves, and of allowing the patient in the meanwhile to breathe through another channel. The principle is excellent (as I shall show you by and by), where there is a permanent obstacle to the admission of air to the lungs through the larynx; but in hydrophobia there is no such permanent obstacle to surmount. Though your patient, in laryngitis, should be at the point of death, yet open his windpipe, and he breathes again and is safe; but it is not at all uncommon for a hydrophobic patient to lose his spasms, to swallow well, and to breathe easily, yet he does not recover. This amendment is the prelude of death, the last flicker of the expiring lamp. Since I lectured upon this subject before, Dr. Latham has told me the following circumstance respecting a patient whom he treated for hydrophobia, in the Middlesex Hospital. He went one day to the ward, fully expecting to hear that the patient was dead. But he found him sitting up in his bed, quite calm, and free from spasm; and he had just drunk a large jug of porter. 'Lawk, sir (said a nurse who stood by), what a wonderful cure!' The man himself seemed surprised at the change. But *he had no pulse*; his surface was cold as marble. In half an hour he sank back, and expired. Furthermore the experiment in question has been tried, and it has been tried by its proposer, Mr. Mayo, upon the dog, without affording, as Mr. Youatt assures us, the slightest relief. In the matter of cure, surgery, I fear, is as impotent as physic.

Not so, however, in the matter of prevention: that is the most important object of our practice—that, and the *euthanasia*. The early and complete excision of the bitten part is the only measure in which we can put any confidence: and even here we are met with a source of fallacy. In the majority of cases, no hydrophobia would ensue, though nothing at all were done to the wound. How can we know, then, that the disease is ever prevented by its excision? No doubt many persons go through the pain of the operation needlessly. But in no given case can we be sure of this. They get, at any rate, relief from the most harassing suspense, with which they would probably have been tortured for months. And if a large number of bitten persons, who had suffered the wound to heal as it would, could be compared with an equal number who had had the bitten part cut out, hydrophobia would be found a frequent consequence of the bite in the first class—a very rare consequence of it in the second. Mr. Youatt, who trusted to caustic, and who had himself been bitten seven times, tells us that he had operated, with the caustic, on more than four hundred persons, all bitten by dogs respecting the nature of whose disease there could be no question; and that he had not lost a case. One man died of fright, but not one of hydrophobia.

Moreover, a surgeon of St. George's Hospital told him that ten times that number had undergone the operation of excision there, after being bitten by dogs (all of which might not, however, have been rabid), and that it was not known that anyone had been lost. Mr. Youatt, I say, trusted to caustic; and the caustic he used was the nitrate of silver. But I advise you to trust to nothing but the knife, if the situation of the bite will allow you to employ it effectually. If the injury be so deep or extensive, or so situated, that you cannot remove the whole surface of the wound, cut away what you can; then wash the wound thoroughly, and for some hours together, by means of a stream of warm water, which may be poured from a tea-kettle; place an exhausted cupping-glass from time to time over the exposed wound; and finally apply to every point of it a pencil of lunar caustic. If you cannot bring the solid caustic into contact with every part, you had better make use of some liquid escharotic; the nitric acid, for example. Trousseau recommends, as a ready and quick preventive, the actual cautery—the destruction of the tissues of the bitten part by applying to them a red-hot iron. In my own case—and what I should choose for myself I should advise for another—if I had received a bite from a decidedly rabid animal upon my arm or leg, and the bite was of such a kind that the whole wound could not be excised, or thoroughly cauterised, my reason would teach me to desire, and I hope I should have fortitude enough to endure, amputation of the limb above the place of the injury.

But if the wound be of such a size, and in such a part, that it can be excised, what is the proper way of cutting it out? Were I to give you any opinion, as from myself, upon that point, you might think, perhaps, that I was stepping beyond my proper province. I shall, therefore, again retail to you the advice of my old master, Mr. Abernethy. 'The cell (he says) into which a penetrating tooth has gone must be cut out. Let a skewer be shaped, as nearly as may be, into the form of the tooth, and then be placed in the cavity formed by the tooth; and next let the skewer, and the whole cell containing it, be removed together by an elliptical incision. We may examine the removed cell, to see if every portion with which the tooth might have come in contact has been taken away: the cell may even be filled with quicksilver, to see if a globule will escape. The efficient performance of the excision does not depend upon the extent, but upon the accuracy, of the operation.' Mr. Abernethy was of opinion that when once the poison had been imbibed into the system, nothing ever had done good, and nothing, probably, ever would. He used to add, that as bleeding had been much extolled, had he hydrophobia he would allow a surgeon to bleed him even to death. Like Seneca, he would be willing to have his veins opened, though his disease might not permit him to indulge at the same time, like Seneca, in the luxury of a warm bath.

I say *early* excision is the only sure preventive; but let me repeat that it will, in all suspicious cases, be advisable (if, for any reason, the operation have been omitted in the first instance,) to cut out the wound, or the cicatrix, within the first two months, or at any time before the symptoms of recrudescence have appeared. One would do it, though with less hope, as soon as possible *after* they had appeared; but I do not expect to hear of excision being successful then in stopping the disease. Dr. Bright has recorded a case in which the arm was amputated upon the supervention of tingling, and other symptoms, in the hand, in which the patient had been bitten sometime before; but the amputation did not save him.

Dr. Brown-Séquard takes a somewhat different view. Looking upon the change which so often happens in the place of the bite just before the hydrophobic symptoms declare themselves, as a kind of *aura*, such as not unfrequently precedes a fit of epilepsy, he suggests the excision of a portion of the nerve or nerves distributed to the bitten part.

It has been proposed to fill the wound with ink, and then to wash it until every trace of the ink is gone; in this way, it is conceived, the complete ablution of the poison also will be ensured. With a timid or an obstinate patient, who would not submit to the knife or the caustic, some such expedient ought to be diligently tried; but it would be better to try it *after* excision, or after the application of the escharotic substance. It is impossible to take superfluous pains to obviate so fearful a disease as hydrophobia.

After the wound has been excised or cauterised, it has been recommended that it should be prevented from healing, and made to discharge for a long time, by means of irritative dressings. This may be advisable when thorough excision, or complete cauterisation, cannot be effected; but I should think it quite useless as auxiliary to those expedients, and only likely to keep up, or to produce, a hurtful irritability of the system.

The new power which we have happily obtained of suspending sensation generally by the inspiration of certain vapours, or locally by the æther spray, will contribute to the prevention at least of hydrophobia, by divesting the process of excision of its pain, and therefore of its terrors.

I should perhaps have mentioned before, a theory, and a plan of preventive treatment, which made a great figure in all the journals, foreign and domestic, a few years ago. It was pretended by a Russian physician, Dr. Marochetti, that sometime between the third and the ninth day after a person has been inoculated with the hydrophobic poison, by the bite of a rabid dog, little pustules appear on or about the frænum of the tongue, containing a small quantity of sanious fluid, of a yellow or greenish colour. Pustules of the same kind were declared to exist also under the tongues of the mad dogs themselves. Now Dr. Marochetti pretended further, that if, from the very time of the bite, you gave the patient large doses of the decoction of broom tops, and looked out for the eruption of these pustules, which seldom lasted more than twenty-four hours, you might infallibly prevent the disease by opening and emptying the pustules, and then cauterising them with a red-hot iron; and afterwards causing the patient to gargle his mouth with the same decoction of broom. He held that the poison was deposited there for a short time, and then re-absorbed into the system; and he proposed to prevent such re-absorption. This was a very pretty theory; and took mightily in the medical world. But it has turned out a sort of hoax. I do not mean a wilful hoax on the part of Dr. Marochetti; for I have no doubt that he contrived to hoax himself. These pustules have been looked for again and again; but they have never been discovered in Englishmen affected with hydrophobia; nor in English mad dogs. The truth seems to be that the mucous follicles of the mouth, generally, and those at the base of the tongue, and those beneath the tongue, in particular, are commonly enlarged and exaggerated in the dog, and in the human animal, labouring under the disease; and these enlarged and altered follicles were regarded by the Russian physician as a specific eruption, which furnished the virus and pabulum of the complaint.

As almost every drug that has ever been included in any Pharmacopœia has been administered with the hope of *checking* the *disease*, so a vast number of medicines and measures have been praised as preventives. Some people have great faith in sea-bathing; and they go to the coast to be ducked and half drowned every day for six weeks; and if they escape hydrophobia they conclude that the immersion in salt water has saved them. Some of the specifics, as you may suppose, are great secrets; and they who possess them—whether they believe in them or not is another matter—sell them at no cheap rate to those who, having been bitten by the dog, are weak enough to be bitten again by the quack. The composition of several of them has transpired; and they are found to consist either of ingredients the most insignificant and worthless, or of poisons of which the inefficacy had already been ascertained. The celebrated *pulvis antilyssus*, which was introduced into the London Pharmacopœia, by no less a person than Dr. Mead, was a mixture of ash-coloured liverwort and black pepper. The *Ormskirk medicine*, long famous, and scarcely obsolete yet in the north of England, was made up of bole armeniac, alum, chalk, elecampane, and oil of aniseed. The *Tonquin medicine* was composed of cinnabar and musk: and the *Tanjore pills* were a combination of mercury and arsenic. Even now scarce a year elapses but some correspondent of the newspapers, whose philanthropy is more conspicuous than his judgment or his knowledge, recommends a new and infallible preventive. I confess to you that I have not the slightest faith in any one of them; but as I had a great respect for Mr. Youatt's judgment, and as he was not *quite* so sceptical as I am on this point, and as patients or their friends will insist upon the adoption of protective measures sometimes, when the local means of prevention have been omitted or imperfect, I will tell you the result of his enquiries respecting these prophylactic drugs.

In the first place he never succeeded in curing the disease in the dog with anything that he had ever tried.

In the way of prophylaxis, he experimented with a great number of substances. He thought that the box-wood, which is the basis of some celebrated preventive drinks in Hertfordshire and Kent, had some effect. He tried the alisma plantago, the boasted efficacy of which had been strictly enquired into by the magistracy of Toula, and the receipt purchased by the Russian Government at an immense price. But he had no success with it. He then put belladonna to the test, beginning with two grains of the extract, and increasing the dose to a scruple twice every day, and continuing this for six weeks: and he says he is confident that he saved several dogs; but he lost almost as many. They all became debilitated and most rapidly emaciated.

Then, in the year 1820, his attention was directed to the scutellaria lateriflora, which Dr. Spalding, an American physician, had found highly successful as a preventive of rabies: and upon trial of it, he soon was brought to regard it as really valuable: and (not to tire you with a detail of his proceedings in the interim) he at length combined it with belladonna: 'and the result' (I here quote his own language) 'has been a medicine which I cannot, dare not, call a specific; for it has failed: but the use of which, in the cases of doubt and fear to which I have alluded, I would most earnestly recommend.' He relates two experiments, which seem to have made a great impression upon his mind. They are as follows:—

'Three pieces of tape were thoroughly moistened with the saliva of a rabid dog, and inserted as rowels in the polls of three other dogs. To two the scutellaria and belladonna were given: the third, a fox-hound bitch, was abandoned to her fate. On the twenty-ninth day after the inoculation she became rabid.' The others, at the time this was written, i.e. some months subsequently, were living and well.

He afterwards took the same two dogs, and a third. He moistened two pieces of tape with the saliva of a rabid dog, and inserted them in the polls of one of the old dogs, and of the third dog. Another piece of tape, dragged repeatedly through the mouth of the same rabid dog *twenty-four hours after its death*, was inserted in the poll of the second of the old dogs. This dog and the new one were suffered to take their chance. To the other old dog the medicine was given. In the fourth week the new dog died undeniably rabid. The other two survived.

I repeat that I have no faith in these preventives. But sometimes some of them must be tried; and I would prefer those which are thus sanctioned by Mr. Youatt's good opinion to any others.

And with respect to the established disease, I think that if I were the unhappy subject of it, I should wish to be put into a hot air bath, and thoroughly sweated, and to have morphia injected into my subcutaneous areolar tissue; not so much in the hope of recovering as with a view to the euthanasia. But with all respect to those gentlemen who advocate that practice, no one, if I could help it, should make a hole in my windpipe.

LECTURE XXX.

Epilepsy. Its symptoms and varieties; duration and recurrence of the paroxysms; periods of life at which they commence; warnings. Effects of the paroxysms, immediate and ultimate. Pathology. Anatomical characters. Causes.

THE great functions of which the brain is the material instrument are sensation, thought, and voluntary motion. The influence of the will is a cerebral influence: it reaches and acts upon the muscles through the interposition of the spinal cord. Motions that are involuntary belong more exclusively to the system of the true spinal marrow. Yet cerebral changes, morbid states of the brain, may excite them.

I have shown you that all these functions are liable, under disease, to be separately affected, and each in various ways and degrees. The number of combinations capable of arising out of the several disordered conditions of two, or three, or all of these functions, is very great. Yet the symptoms proper to the nervous system do arrange themselves into groups sufficiently definite and constant to allow of our giving them distinctive names, and making them separate objects of enquiry.

At the same time, as might indeed be expected, the several groups have strong resemblances to each other. They are obviously of the same family: 'facies non omnibus una, nec diversa tamen; qualis debet esse sororum.' Occasionally the features are so nearly alike, that we find it somewhat puzzling to determine with which of the sisters we are conversing; but usually there is some mark or other by which the individual may be identified.

Of these essentially nervous diseases, there are several in which the most prominent and obvious of the phenomena relate to the muscular system; such are, irregular, violent, and involuntary contractions of muscles which, in the healthy state of the body, are subject to the control of the will. I have spoken of two very frightful disorders having this character:—of *tetanus*, namely, in which the muscles of voluntary motion present the most striking symptoms, being affected with tonic spasm; while the sensibility undergoes no other alteration than what is a consequence of that spasm, pain I mean in the muscles themselves; and the intellectual functions continue undisturbed:—and of *hydrophobia*, in which the natural sensibility suffers much, and the mental functions some derangement; yet still the characteristic features of the malady depend upon the irregular and uncontrollable action of muscles usually obedient to volition.

The disease which I am next to consider is scarcely less terrible to look upon, when it occurs in its severer forms, than tetanus or hydrophobia; but it is not attended with the same urgent and immediate peril to life. Yet it is, upon the whole, productive of even more distress and misery; and is liable to terminate in worse than death. You will understand that I am alluding to *Epilepsy*: a disease not painful probably in itself; seldom immediately fatal; often recovered from altogether: yet apt, in many cases, to end in insanity or fatuity; and carrying perpetual anxiety and dismay into those families which it has once visited.

The leading symptoms of epilepsy are, a temporary suspension of consciousness, with clonic spasms; recurring at intervals.

It is impossible to frame a perfect *definition* of epilepsy; nay, so various are its shapes, so numerous its modifications, that no general *description* even can be given of it. It will be necessary for me therefore here (as it has been before) to describe first the most ordinary form of the disease, as a standard; and then to note the several variations from that standard which are known to occur in practice.

A man, then, in the apparent enjoyment of perfect health, shall suddenly utter a loud cry, and fall instantly to the ground, senseless, writhing, and convulsed. He strains and struggles violently. His breathing is embarrassed or suspended; his face, which at the very instant of the fall had assumed a corpse-like pallor, soon becomes turgid and livid; he foams at the mouth; a choking sound is heard in his windpipe; he appears to be at the point of death by apnœa. But presently, and by degrees, these alarming phenomena abate, and at length cease; the patient is left exhausted, heavy, stupid, comatose: but his life is no longer threatened. And in a short time he is once more to all appearance perfectly well. The same train of morbid phenomena recurs however, again and again, at different, and mostly at irregular intervals.—This is a brief description of the most ordinary form of epilepsy.

The suddenness of the attack is remarkable: in an instant, when it is least expected by himself or by those around him, in the middle of a sentence or of a gesture, the change may take place; and the miserable sufferer is stretched foaming, struggling, and insensible upon the earth. This fearful suddenness is expressed in the name of the disease, ἐπιληψια, a seizure, an abrupt invasion. The ancients, among whom the complaint was well known, superstitiously ascribed it to the malice of demons, or to the anger of their offended deities. If a person were seized with epilepsy in the forum, it was considered an ill omen, and the meeting was at once dissolved, and all public business suspended for that day. Hence the disease was called *morbus comitialis*. *Morbus qui sputatur* was another of its names, because those present were accustomed to spit upon the epileptic man, or into their own bosoms; either to express their abomination, or to avert the evil omen from themselves. In this country its common designation is the *falling sickness*: or, more vaguely, *fits*. The cry which is frequently, though not always, uttered, is sometimes a husky groan, but generally a piercing and terrifying scream. Women have been thrown into hysterics upon hearing it. It is said to have caused pregnant women to miscarry. Even the lower animals appear to be sometimes startled and alarmed by a note so harsh and unnatural. Dr. Cheyne informs us that upon one occasion 'a parrot, himself no mean performer in discords, dropt from his perch seemingly frightened to death by the appalling sound.'

The involuntary muscular contractions are of both kinds: first the tonic spasm, then, after a brief interval, the clonic convulsions. In most of the fits of which I have happened to see the beginnings, the first effect of the spasm has been a twisting of the neck, the chin being brought round, sometimes in a succession of little jerks, towards one shoulder; and usually one side of the body is more strongly warped, and then agitated, than the other. The limbs contract rigidly, turning the body partly round; the hands are firmly clenched, the thumbs bent towards the palms, the toes curved downwards, and the feet arched. And then convulsive struggles begin. The face is frightfully distorted, the brows are knit; the eyes sometimes quiver and roll about, sometimes are fixed and staring, sometimes turned up beneath the lids, so that the cornea is hidden, and the white sclerotica alone is visible, their pupils, when seen, are seen to be dilated; the mouth is twisted awry; the tongue, thrust between the teeth, and caught by the violent closure of the jaws, is bitten, often severely, and the foam that issues from between the teeth is reddened by blood. The arms and legs are thrown about, striking forcibly the chest of the patient, or bruising themselves against surrounding objects, or inflicting hard knocks upon the friends and neighbours who have hastened to his assistance. At length the struggle has reached its crisis, the limbs are suddenly stretched out, the sufferer draws a deep sigh, and the convulsions cease.

Meanwhile, with the tonic spasm the thorax becomes fixed; the breathing is arrested or interrupted, presumably by a spasmodic closure of the glottis; the countenance becomes turgid and indicative of obstruction to the venous circulation, the cheeks and lips are purplish and livid, and the veins of the neck and forehead are visibly distended. The heart beats tumultuously against the ribs, the pulse grows frequent and feeble, and sometimes ceases to be tangible at the wrist during the height of the fit, and begins to be felt again as the spasms subside. During their violence it frequently happens that the urine and excrement are voided, and seminal emission sometimes takes place. The spasmodic contraction of the muscles is occasionally so powerful as to dislocate the bones to which they are attached: the joints of the jaw and of the shoulder have been thus put out; and the teeth are sometimes broken.

The short and graphic description of this terrible scene by Lucretius has often been quoted:—

Subitâ vi morbi sæpe coactus
Ante oculos aliquis nostros, ut fulminis ictu
Concidit, et spumas agit, ingemit, et tremit artus,
Desipit, extentat nervos, torquetur, anhelat,
Inconstanter et in jactando membra fatigat.

When the convulsive paroxysm is over the patient falls into a deep sleep. You might imagine that he slept from exhaustion, like a man worn out by great fatigue; but there is something more than this; the patient passes into a state of incomplete coma, or rather the insensibility continues after the convulsions have ceased. When he wakes he is often confused and incoherent for a time; by degrees, however, he resumes his ordinary appearance and condition; but he remembers nothing of what passed during the fit.

This, then, is one form, the most severe and the most common as well as the best marked form, in which an epileptic attack occurs.

But there is a large class of cases in which the symptoms are much more mild. There is very slight and transient, or even no convulsion at all; no turgescence of the face; no foaming at the mouth; no cry: but a sudden suspension of consciousness, a short period of insensibility, a fixed absent gaze, a totter perhaps, a look of confusion; the patient is like a man in a short trance, but he does not fall. This is momentary; consciousness presently returns; he resumes the action in which he had been previously engaged, and is not always aware that it has been interrupted. Sometimes, with this temporary abeyance of the mental functions, there is some slight evidence of convulsion or involuntary action; the fingers of one hand, or less commonly of both, are moved irregularly, and without any object; or the eyes roll or are turned upwards; or the muscles of the face are twitched. Sometimes the patient is himself aware of what has been his condition, but shows some cunning in endeavouring to conceal it.

This slighter attack is called by the French, *petit mal*; while the severer form is named *grand mal*. The former is spoken of also as *epileptic vertigo*, and distinguished by that appellation from the *epileptic fit*.

Of affections so different in degree, and in some respects so dissimilar in kind, you may be disposed to ask whether they really constitute the same disease. That they are essentially of the same stamp, we have this evidence; that both forms of attack occur in the same individuals. Sometimes a patient will suffer many recurrences of the epileptic vertigo, and at length will become affected with violent epileptic fits. Or the two forms will intermingle, sometimes the milder happening, sometimes the severer. In such cases we cannot doubt that the attacks are in their nature the same, though different in their form and degree. And when (as sometimes happens) we meet with the slighter disease alone, we cannot refuse to assign to it the character and the name of *epilepsy*. Trousseau held indeed that the *petit mal* was more surely characteristic of true epilepsy than the *grand mal*.

Between the two extremes, there are many links of gradation. Sometimes the sufferer sinks or slides down quietly, and without noise, is simply pale, is not convulsed at all, but insensible; much like one in a state of syncope. After recovering, he remains sick, languid, and confused, during the remainder of the day.

You will perceive, from what I have now said, the difficulty of giving any single description of epilepsy which will include all its varieties. It is of course still more difficult to offer a strict definition of the disease. Cullen defines it to be 'musculorum convulsio, cum sopore.' Dr. Copland furnishes a larger and more comprehensive definition: 'Sudden loss of sensation and consciousness, with spasmodic contraction of the voluntary muscles, quickly passing into violent convulsive distortions, attended and followed by sopor, recurring in paroxysms often more or less regular.'

But almost every one of these circumstances may, in its turn, be wanting. There may be no spasm or convulsion; there may even be very slight and transient interruption of consciousness; there may be no subsequent coma or sopor; there may be no recurrence of the attack.

Yet I trust that you have now obtained some general notion of what is meant by an epileptic seizure. And I go on to enquire into several most important points connected with the paroxysms.

In the first place, they vary somewhat, yet probably not much, in *duration*. Sometimes, as I have already stated, the seizure is slight, and does not occupy more than a moment or two of time. But even in the severer attacks the convulsions are generally over in a very few minutes. Authors speak of variations in this respect between five or ten minutes and half an hour. Trousseau, however, is positive that the clonic spasms do not continue longer than from half a minute to two minutes; that the whole of the spasmodic portion of the attack varies between two and three minutes; and that an attack lasting from four to six minutes is so rare a thing, that one might live for years among epileptics without witnessing it.

If you fix your attention upon the face of your watch, and note the progress of the minute hand while it is making two or three revolutions, the time so consumed will seem wonderfully long and tedious; and this sense of protracted duration will be felt more impatiently if you are looking with painful anxiety on a surgical operation, or a fit of epileptic convulsions. You will be very apt to miscalculate the lapse of time. For my own part, I am prepared to accept M. Trousseau's evidence on this point, especially as he professes to have gathered it watch in hand, and repeatedly.

Attacks that are spread over three, or four, or more hours, consist rather of a succession of paroxysms, with indistinct intervals of comatose exhaustion. In this protracted succession of fits, (which Trousseau distinguishes from both the *grand mal* and the *petit mal*, and calls the *status epilepticus*,) the patients often die.

The periods at which the paroxysms *return* are extremely variable. Occasionally the patient expires in the first paroxysm; occasionally, after recovering from it, he never has another. Both of these occurrences are rare. Rather more frequently the fits recur at very long intervals; at the distance, I mean, of many years. Most commonly of all, they revisit the sufferer at irregular periods of a few months or weeks: sometimes they are repeated at intervals of a few days: sometimes every day, or every night: and not unfrequently they take place many times in the twenty-four hours. This extreme frequency of repetition belongs principally to the slighter incomplete seizure, the *petit mal*. Sometimes the fits observe a strictly *regular* period of return; but, for the most part, they come quite uncertainly and *ir*regularly.

The *time of life* at which the fits *commence*, and the circumstances attending their commencement, are deserving of notice. They not uncommonly begin in infancy. Those fits of convulsion to which young children are subject during the first dentition, and which sometimes appear to depend upon the irritation of teething, and sometimes upon manifest disorder of stomach and bowels—those fits are not distinguishable in their phenomena from genuine epilepsy; and we must reckon them as instances of epilepsy. If you are able to trace the early history of an adult epileptic, you will not seldom find that he or she suffered infantile convulsions. Among twenty-eight cases, carefully investigated by Dr. Russell Reynolds in reference to this point, fourteen, exactly one half, of the patients had had convulsions during their infancy.

The epileptic attack may come on, for the first time, at *any* age. According to Dr. Bright (whose account of the disease, though short, is particularly perspicuous), the most common periods are about the age of seven or eight years, probably about the time of the second dentition; and from fourteen to sixteen, shortly before the age of puberty. And the disease (he says) is very apt to occur for a few years subsequently to this. But sometimes the first fit has taken place between the ages of thirty and forty; in not a few cases, after sixty; and occasionally in quite the decline of life. According to M. Trousseau's experience the disease is more common, in both sexes, during adolescence than at any other period. Niemeyer states that epileptic attacks are most numerous during the first three decennial periods of life, and especially so during the second.

The first accession of the disease takes place more commonly before than after puberty. Of sixty-six epileptic women, in whom the outset of the disorder and the first period of menstruation were carefully noted, thirty-eight had epileptic fits before, and twenty-eight not till after that period.

The attacks are very apt to come on during the night; in the commencement of the disease they frequently are *confined* to the night. They are said chiefly to occur at the moment when the patient is sinking into sleep, or awaking from sleep. How far this is true I cannot tell. When the disease is *yielding*, the fits often happen in the night only; so that after they have, for a certain period, taken place in the day-time, or during the day and the night indiscriminately, it is reckoned a good prognostic sign if they begin to restrict themselves to the night. Some patients, under these circumstances, suppose that the physician has particular remedies that will make the fits happen in the night rather than in the day; and they ask for these remedies.

Sometimes each paroxysm arrives unannounced and unexpected; sometimes distinct *warnings* of its approach are given. The latter I believe to be less frequent than the former. Georget affirms that premonitory symptoms do not occur more than four or five times in a hundred cases. I am sure that this is much understated. Dr. Sieveking, in his instructive little volume on epilepsy, tells us that his experience tallies with that of Romberg, who had observed premonitory symptoms in about one half of his epileptic patients. When warning symptoms do happen, they are sometimes spread over a considerable period; several hours, or a whole day: sometimes they last just long enough to enable the patient to remove from a situation in which a fall would be attended with unusual danger: to dismount from horseback, to lie down in a boat, to get away from the fire-place, from the edge of a precipice, from the vicinity of water, to assume the horizontal position of his own free will and in his own manner, or to give notice to those about him of what is going to befal him. In some cases the warning is too short and sudden even for this. The *kind of notice* that he receives is very variable indeed. Often it consists in some unnatural state of the mind, the feelings, the temper; the patient is fidgety, irritable, low-spirited, timid, sullen; or, on the other hand, he feels unusually strong, hearty, and cheerful.

Outbreaks of unmeaning laughter, and, contrariwise, gusts of vague and extreme terror, have been chronicled as occasional heralds of an impending fit. Sometimes there is a notable change in some one or more of the natural functions, or of the bodily sensations; the patient loses his appetite, or his appetite becomes voracious; a great flow of urine takes place; he smells an ill smell, is aware of a strange taste, hears extraordinary noises, or sees illusory spectral visions; not mere specks floating before him—muscæ volitantes—but distinct forms of persons and things not present. This is not very common, but it certainly happens. The late Dr. Gregory, of Edinburgh, was assured by a patient of undoubted veracity, that always, when he had a fit of epilepsy approaching, he fancied that he saw a little old woman in a red cloak, who came up to him, and struck him a blow on the head, and then he immediately lost all recollection, and fell down.

Headache, giddiness, dim or dazzled vision, are all of them common symptoms among those which have been observed to be precursory of epilepsy. Sometimes there are circumstances which are apparent to a by-stander; a flushing of the face, or lividity, or pallor: delirium; difficult articulation; vomiting. Of twenty-one epileptics treated in the hospital at Wilna, by Joseph Frank, vomiting announced the paroxysm in seven. Some of the uneasy feelings are apt to come on and to continue even for several days previously to the attack; restlessness in particular, disturbed sleep, distressful dreams, a peculiar and sudden coldness of the extremities. An internal *working* is a phrase often used by such persons to express a sensation which is probably indescribable.

But the most curious precursory symptom of all, if we except the spectral illusions, is what is called the epileptic *aura*. This is a sensation which is likened by different patients to different things; to a stream of warm or of cold air, to the trickling of water, to the creeping of a spider. The sensation proceeds commonly from some distant part of the body,—from one of the extremities, from a thumb, a finger, a toe, or from some spot on the trunk,—and runs along the skin towards the head; occasionally it gets no further than the pit of the stomach: as soon as it reaches the head, or stops at the epigastrium, or elsewhere, the patient's consciousness forsakes him, and the paroxysm declares itself.

There seems to be some analogy between this epileptic aura and the well-known sensation, to be spoken of hereafter, of a ball rising from the stomach to the throat, and constituting the globus hystericus; except that in cases of epilepsy the sensation commonly begins in a limb, and not in the stomach: and the fit comes on when it reaches the head, and not the throat. Sometimes, I think, these two sensations are blended.

In some instances, spasmodic contractions of the muscles of the part whence the aura proceeds are observed to take place prior to the more general state of spasm.

This aura is surely a very curious phenomenon. It has been thought to depend upon some change propagated along the nerve upwards to the brain, and to be sometimes connected with some injury done to, or some morbid impression made upon, an afferent nerve. I think that this explanation may apply to some cases.

Dr. John Thomson, of Edinburgh, used to state in his lectures, that he had known epilepsy to begin with an aura proceeding from an old cicatrix in the side. In a patient of my own, who was subject to epilepsy, the warning sensation commenced in one of his thumbs, which presently after began to be twisted inwards; but by tying his handkerchief tightly round the thumb, he could prevent the fit. Dr. Seymour mentions the case of an epileptic boy, who had learned to protect himself against a threatened paroxysm by biting his tongue. In a case recorded by Dr. Hughlings Jackson, the threatenings took the shape of contractions of the right leg, and the incipient fit could be warded off, or rather could be cut short, by strong friction applied to the calf of the leg, while the limb was forcibly extended by pressing down the heel.

In most cases the aura probably depends upon some change within the head, and is analogous to the numbness or tingling that is often felt in some part of the body or limbs immediately before an attack of palsy or apoplexy. There is no real inconsistency in this twofold explanation: the source of the aura may be centric or eccentric; so also may the original exciting cause of the paroxysm; as, in due time, I shall explain to you.

A knowledge of these warning circumstances is clearly of importance, always so far as respects the comparative security of the patient during the attack; sometimes as affording us the opportunity of staving off the fit altogether. And it is necessary to remark, that they sometimes give, as it were, a *false alarm*; they occur, and yet, although no measures of prevention are taken, no paroxysm follows.

The phenomena that *succeed* the paroxysm are of great interest and moment.

I have already apprised you that the convulsions generally terminate before the insensibility is over: the patient draws, perhaps, a long gasping sigh, and ceases to struggle. Some few persons are quite themselves again in a moment or two; some appear to recover consciousness, and then fall into a deep and prolonged slumber; but many do not regain their consciousness at all upon the cessation of the convulsions, remaining in a state of profound stupor, from which, however, they can generally be roused for a time. This state of coma (for it is nothing else) has been known to last a week. After the patient emerges from it, he is sometimes merely languid and inert; sometimes he is like a person stunned, bewildered, or in a state approaching to idiotcy, which gradually clears up; sometimes he is furiously delirious for a while; not unfrequently there is a degree of partial paralysis, which also usually soon goes off, though occasionally it is permanent; his eyes are fixed, or he squints, or his pupils are dilated, or he drags a leg, or he falters in speech. Sometimes he is completely hemiplegic. Very commonly he speaks of headache, or discomfort of some kind.

For the most part, however, the patient feels 'all right' again, sometime during the very day of the epileptic attack, or the day after. In proportion as its damaging influence is prolonged, the final prognosis becomes more gloomy.

It is very seldom that the patients have any recollection whatever of what has passed during the fit. Many of them are not aware that they have had a fit: and those who do know it, discover the fact by finding themselves wet or dirty; by the injuries they have received during the convulsions; by the soreness of the bitten tongue; by their blood-shotten eyes; by the bruises of their limbs; or by the confused or painful sensations which they subsequently experience, and which they have learned to associate with the conviction that a fit has happened, from having been informed, on previous occasions when they felt the same sensations, that they had suffered a paroxysm of insensibility and convulsions.

Upon the whole, it is not often that any permanent ill effect can be noticed as having been left behind it by any one single fit; but, unhappily, this can seldom be said of their repetition.

Doubtless a single paroxysm does frequently leave the patient in a worse condition than that in which it found him; but this does not become perceptible to an ordinary observer, until after the alteration has been magnified and made apparent by repeated fits, and repeated small additions to the permanent injury. The friends of the patient remark that his memory is enfeebled in proportion to the number of the attacks; that his mental power and intelligence decline. His features even assume, by degrees, a peculiar character; he becomes subject to insane delusions, and too often he sinks at last into utter and hopeless fatuity. It is this tendency which renders epilepsy so sad and fearful a disease.

Foville affirms, that the intellectual degeneration is more constant, and comes on more early, in persons who are principally afflicted with the epileptic vertigo, the *petit mal*, the imperfect seizure, than in persons in whom the *grand mal*, the violent and decided paroxysm, takes place. Dr. Copland, on the other hand, is of opinion, that 'the more severe the fits, the more is that result to be dreaded.' This is a point which can only be settled by statistical facts. And as we all have the opportunity of collecting some such facts, and of adding them to the general stock, I mention this, and some other points that are still uncertain or disputed, as worth bearing in mind. More, probably, depends upon the *repetition* of the fits, than upon their precise *nature* or *severity*. Cases do occur in which epileptic persons preserve their faculties to a good old age; but those who are early epileptic do not often attain old age; and *whenever* the disease comes on, if it repeat itself frequently, it is followed much more often than not by impairment of the mind, or by some apoplectic or paralytic affection, which implies and accompanies the mental change. You will sometimes hear the cases of Julius Cæsar, of Mahomet, and of the first Bonaparte quoted as examples of high intellectual power existing and remaining in spite of epilepsy:—and it is allowable, perhaps, to make use of such cases for comforting the friends of epileptic persons; or for giving the advantage of sustained hope to the patient himself. But, in truth, these cases are not worth much. Napoleon is said, I know not upon what authority however, to have suffered something like epilepsy during sexual intercourse. This is not very uncommon in persons subject to that disease. There is credible testimony that he had an epileptic fit three weeks before he checkmated the Austrian armies in 1805, and soon after he left his camp at Boulogne. With respect to Julius Cæsar, we learn from Suetonius, that it was only in the latter part of his life that he laboured under epilepsy; and that he had two attacks while engaged in business.

Having now described the phenomena of epilepsy; the periods of life at which it is most apt to commence; its varieties; and its tendency and most common termination: let us next enquire what is known respecting the real seat and nature of this strange and melancholy complaint.

The functions that are affected are clearly functions of the *brain.* Sensation, thought, and motion regulated by the will, are the natural functions of that organ. The temporary abeyance of sensibility, thought, and volition; and violent and irregular action of the muscles which are thus withdrawn from the government of the will; constitute a paroxysm of epilepsy. We have, in this malady, another illustration of the fact, that when the controlling influence of the cerebrum is suspended, the peculiar functions of the spinal marrow are apt to be exercised, not only in a disorderly, but also in an unusually energetic manner. That the brain and the spinal marrow, though physiologically distinct, are yet intimately connected with, and dependent upon, each other, a thousand familiar facts assure us. What I now wish to make plain to you is that Marshall Hall's dogma, that all convulsive diseases are diseases of the spinal marrow, cannot be properly or strictly applied to this convulsive disease of epilepsy. It is true that the spinal cord is concerned whenever there is convulsion; but it is concerned in every *voluntary* movement also, through the instrumentality of the brain itself; and it may be, and often is, irregularly influenced by a disordered and unnatural state of the brain. Tetanus may fairly be regarded as a disease of the cord and its proper appendages. The spasms arise and reach their height, while the powers of thought and sensation are unimpaired, and while volition subsists, although the morbid condition of the cord renders it ineffectual. In epilepsy these cerebral functions are always implicated. There is *always* a loss of consciousness: and in the epileptic vertigo, the *petit mal*, there is frequently a suspension of consciousness only, *without any convulsion at all.* Those very rare cases in which (it is alleged) slight spasmodic movements are noticed without any perceptible interruption of consciousness, I should exclude from the category of epilepsies, unless their epileptic character was certified by the previous or the subsequent occurrence of a clear and unequivocal *fit.* The brain, therefore, we must consider to be essentially concerned in this disorder: and in that belief let us next enquire what has been ascertained respecting the *morbid anatomy* of epilepsy.

Suppose that a person who has had epileptic fits, but in whom they have not been followed by any durable affection of the intellectual or locomotive functions, dies of some other malady; and that you have the opportunity of minutely examining the condition of his nervous system. Often you will find nothing at all which can throw any light upon the occurrence of the epileptic paroxysms; no appreciable alteration whatever in any part either of the brain or of the spinal cord. In other cases you may discover some organic disease within the head: a tumour, a spiculum of bone projecting from the skull. Have you then detected the cause of the disorder? All that can be said is, that the piece of bone or the tumour was probably a *predisposing* cause of that derangement of the nervous substance which determined the paroxysms; the derangement itself, if, indeed, it were of such a nature as to be cognisable by our senses, has gone, with the symptoms; the tubercle or bone having in the mean time remained, without any sign which could betray its presence.

M. Foville, whose testimony in this matter is entitled to much weight, affirms that in persons who have been subject to epilepsy, uncomplicated as yet with any permanent disorder of the intellect, or of the faculty of voluntary motion, and who have died *in the fit*, constant alterations are observable within the head; viz., a strong injection of the vessels of the encephalon. The membranes, the brain, and the cerebellum, are gorged, he asserts, with livid blood. But he goes on to say that this is to be ascribed to the mode of death; that we see the same appearances in persons who have died by hanging, or by any form of apnœa; that they are not peculiar to epilepsy, and do not explain the attack, but only point out the way in which it has been fatal.

The same may be said of those little red points of ecchymosis which after a fit are often to be seen upon the forehead, throat, and chest of the patient; and which not improbably take place also, sometimes, in the nervous tissue of the brain itself, and help to account for some of the symptoms that remain after the convulsive paroxysm is over.

Let us go a step further, and enquire into the state of the encephalon in those persons who, having suffered epilepsy, had, before death arrived, been affected with some permanent impairment of the mental functions, or (what often goes along with such impairment) with some degree or other of muscular paralysis or debility.

The most common alterations met with in the brain in such cases are the following.

Induration of the white matter of the brain, which presents a dull appearance; sometimes, besides the hardening, a general injection of the white matter; and in the majority of cases a marked dilatation of the blood-vessels. In some instances the consistence of the white matter is diminished, it is soft and flabby; but there is the same dilatation of the blood-vessels. These changes pervade the whole of the white matter in every part of the brain. At the same time the gray matter is found irregular on its surface, marbled or of a rosy colour in its substance, and sometimes altered in consistence. And in many cases the membranes are found to be adherent in some parts to the convolutions with which they lie in contact.

Such are the results of the experience of careful observers in regard to the morbid anatomy of epilepsy; of Morgagni, of Foville, of MM. Bouchet and Casauvielh, and of Professor Van den Kolk. The last of these authors affirms that in the medulla oblongata especially there are constant changes; hardening from the interstitial deposit of a finely granular matter; or a soft and swollen condition; dilatation of the blood-vessels to three times their natural dimensions, with much thickening of their walls. In a series of strict examinations of dead epileptics, made by Dr. Boyd when he was physician to the Somerset County Lunatic Asylum, it was found that the absolute weight of the brain was in almost every case above the average weight of the healthy brain, and (what is more noteworthy) that the relative weights of the two hemispheres of the same brain were unequal.

Now some of these changes are such as may be produced by chronic inflammation of the brain, or of its membranes. All of them are, I imagine, *consequences* of repeated paroxysms of epilepsy; they are the very same as are frequently met with in cases of insanity complicated with paralysis, and they elucidate, therefore, the connection of these affections; but they certainly teach us little or nothing of that very condition of the nervous mass upon which the epileptic paroxysms depend. And, in truth, to expect to find in the brain the traces of convulsions that have passed away, would be as unreasonable as to expect to find there the traces of former voluntary movements.

Of those organic intracranial changes which may be regarded as strong predisposing causes of the paroxysms, my own experience accords with that of Dr. Bright; who states, that most frequently they are such as affect the surface, rather than the deeper-seated parts of the brain: tumours external to the cerebral matter; alterations in the membranes that envelope the organ, or in its bony case; the skull being very often unnaturally thick, heavy, and uneven. Various altered states of the spinal marrow have also been recorded.

Epilepsy, then, is plainly a *cerebral* and not a merely *spinal* affection, and our conception of its pathology will become, I think, more clear and definite, if we compare and contrast one of its forms with the parallel affection, hemiplegia. In many cases, and in a certain sense, epilepsy, like hemiplegia, is a one-sided disorder. Although the spasm is rarely confined to the muscles of one side, its beginnings are often unilateral. The disorder, in these cases at least, might fitly be called cerebral *hemi-spasm*, and the use of that term would conduce to the formation of more distinct, and, perhaps, more accurate notions as to its true nature. The same regions of the brain are implicated in hemiplegia and in hemispasm, but they are affected in different and opposite ways. Those regions you will again recognise as comprising the corpus striatum, the thalamus opticus, and the district round about them. In the one form of disease, Dr. Hughlings Jackson remarks, nerve tissue is destroyed: in the other, it is simply unstable. Hence hemiplegia is more or less permanent; hemispasm is fugitive and occasional. In hemiplegia nerve force is shut off from the motor tract; in hemispasm it descends from time to time in disorderly and terrific violence. The extension of the spasm to certain muscles that act bilaterally is accounted for by Dr. Broadbent's theory, and furnishes fresh evidence of its truth.

But what do we mean by *instability* of tissue? The word is not mine, but I adopt it as admirably expressive of some change, general or partial—some defect other than and short of destruction—in the nervous tissue; rendering it morbidly ready to respond, and causing it to respond unsteadily and irregularly, to ordinary impressions: and here Dr. Hughlings Jackson's suggestions with respect to *arterial* (*and venous*) *regions* of the brain are well worthy of attention. The portions of the brain that clearly are concerned in both of the contrasted disorders are fed by the branches of a single artery which has little or no anastomosing communication with other arteries;—the middle cerebral artery. Now if the functions of that artery happen to flag, or to be imperfectly performed—whether from disease in its walls, from spasm of its muscular fibres, from slight obstructions of its channel by particles of fibrin, from thrombosis of some of its twigs, or from any other cause—it is not difficult to conceive that the district supplied by it may, without any actual destruction of tissue, be insufficiently sustained, become infirm, unsteady, unstable, prone to discharge itself of force upon slight irritation. Or may it not be that the brain, or some part of it, becomes inadequately or unequally possessed with its proper force? For it is an accepted doctrine in modern physiology that the nerve centres are repositories of nerve force which is being constantly spent in the various functions of the body: that in every movement, every act of thought, every bodily or mental sensation, nerve-force is parted with, and tissue probably wasted—both to be as constantly restored and renewed, during rest and sleep, by the ceaseless process of nutrition. The whole organ is thus maintained in a state of stable equilibrium. But in impaired and unstable conditions of the brain-mass, the equilibrium is endangered, becomes itself unstable; the functions of its various parts are exercised unsteadily, the balance from time to time trembles, and those little falterings and troubles are apt to ensue which constitute and characterise the *petit-mal*: or the brain may become so unequally charged with its peculiar force, as to compel its readjustment by the violent explosion of the *grand-mal*, of the epileptic paroxysm. Then, as in the atmosphere after a thunderstorm, there is calm for a time. But permanent damage may have been done during the commotion, fresh flaws or larger in the substance of the brain, or of the machinery of its circulation, in the one case—trees scorched and split, or buildings shattered in the other. Gradually the brain reloads itself; the nerve force still collects unequally; and the same explosive tumult again and again, and each time with added mischief, is likely to occur. How, or why just then, the distributive discharge is made, are questions of great interest.

In thus comparing the phenomena of hemiplegia with those of epileptic hemispasm, this grand distinction between them must never be forgotten—that in hemiplegia there is no necessary implication of the structure or the functions of the cerebral hemispheres, whereas in epilepsy their functional implication, at least, is always denoted by the suspension of consciousness. The area of brain disturbance is wider in the one case than in the other.

Besides the morbid appearances that are visible *sometimes only* in the nervous centres themselves, there are others, which it is of great importance to attend to, situated in other parts of the body, and at a distance from those centres: diseased states of the liver; biliary concretions; granular kidneys; renal calculi; stones in the bladder; worms in the alimentary canal; diseases of the uterus; and of various other parts. And these morbid conditions have often, no doubt, an intimate connection with the epileptic paroxysms. Accordingly some authors make almost as many varieties of epilepsy as there are organs of the body; they specify the cerebral, the spinal, the cardiac, hepatic, gastric, intestinal, renal, genital, uterine, and so on. It will be sufficient, however, to consider two species only: that, namely, in which the fits seem to depend solely upon disease or disorder of the great nervous centres, and especially of the brain; and that in which they seem to depend upon something wrong out of, and beyond, those centres. Most authors who have written on epilepsy make this distinction, although they employ different terms to express it: cerebral and occasional; primary and secondary; idiopathic and sympathetic; centric and eccentric. The last two terms are the best. In the eccentric species a morbid influence is conveyed by afferent nerves from the seat of the local malady to the nervous centres, and the spasms denote their responsive action. This distinction is practically important both as respects the prognosis and the treatment.

It was formerly a common notion—I can scarcely think that it is so now—not only that such congestion as Foville describes actually takes place, but that it is the cause of the paroxysm. It may be worth while to state shortly the reasons that are opposed to this conclusion.

In the first place it is not easy to conceive that the congestion could so suddenly arise and subside again as it must sometimes do if it were the immediate determining cause of the fit: within the space of a single minute, for example.

And in the second place, the signs of external congestion and fulness, by which signs we measure the amount of the *internal*, are most marked just when the symptoms of the paroxysm begin to subside and disappear. The congestion, which is the result of obstructed venous circulation, which again is a consequence of the muscular spasms, cannot be regarded as the *cause* of the convulsive symptoms.

The very opposite condition of the cerebral circulation, sudden emptiness of the blood-vessels of the brain, is now generally believed to determine the fit. Clearly it must be some condition that may be both sudden and transitory; and such a condition an abrupt and brief privation of arterial blood would furnish. This view is set forth and supported by Kussmaul and Tenner in their treatise on the nature and origin of true epilepsy, which you may read in one of the volumes of the New Sydenham Society. The same view is strongly advocated in a lecture upon epilepsy, published in the 'British Medical Journal,' by Dr. George Johnson; who attributes the sudden anæmia of the brain to spasm of the muscular fibres of the minute cerebral arteries. In experiments made upon rabbits, the same phenomena were produced by profuse and rapid hæmorrhage; and by placing ligatures upon the carotid and subclavian arteries, and so shutting off the supply of arterial blood from the brain. In each case there ensued 'the dilated pupil, and the tonic spasm, quickly followed by violent clonic convulsions.' All this is consistent with the phenomena of the epileptic paroxysm, and with the pallor which immediately precedes it.

A word or two more about the predisposing causes of epilepsy.

There is no doubt that a tendency to epileptic disease is frequently *hereditary*. It may be derived from parent to child; or it may leap over a generation or two, and appear in the grandchild or great-grandchild; or it may be traceable only in the collateral branches of the ancestry. This is just what takes place in other hereditary maladies. You may often notice also that other forms of nervous disorder prevail in the same families.

MM. Bouchet and Casauvielh found that among 110 instances of epilepsy, 31 were hereditary. Of 321 persons afflicted with epileptic insanity, and seen by Esquirol, 105 were descended from insane or epileptic parents.

Again, a tendency to epilepsy is very often found to go along with an *unnatural form of the head*, which is pinched up like a sugar-loaf; or misshapen and unsymmetrical, one half being unlike its fellow; or in some way or other oddly configurated. Epilepsy is no uncommon accompaniment of chronic hydrocephalus.

And thirdly, the *scrofulous diathesis* is a strong predisposing cause of epilepsy. Dr. Cheyne even holds that epilepsy is as certain a manifestation of the strumous disposition, as tubercular consumption, or psoas abscess. Now, of the two predisposing circumstances last mentioned, it may be observed, that they commonly merge in that which preceded them: the strumous diathesis, and a particular conformation of the head, are both very likely to descend from parents to their progeny.

Whether the sex has any influence in determining a predisposition to epilepsy, is a question that remains to be settled. Foville thinks it is most common in females; Dr. Elliotson, in males. *I* have certainly seen more epileptic boys and men than girls and women. But the casual experience of a single observer is not enough to determine the point. We want numerical statements on a large scale. At the close of the year 1813 there were 162 male epileptics in the Bicêtre; 289 female cases in the Salpêtrière. Jos. Frank observed that, of 75 patients, 40 were females. Dr. Sieveking states, upon the authority of the Registrar General's returns, that during seven consecutive years the deaths from epilepsy in England and Wales numbered altogether among males 6,729 and among females 6,147.

LECTURE XXXI.

Epilepsy, continued. Recapitulation. Exciting causes. Simulated Epilepsy. Diagnosis. Prognosis. Treatment: during the fit; during the intervals; during the warnings.

At our last meeting I began to speak of epilepsy. Let me rapidly retrace the ground we then passed over.

An epileptic seizure may be very severe; or very slight. The very severe attacks are characterised by a sudden cry, immediate loss of consciousness, tonic spasm rapidly followed by general and violent convulsions, and subsequent coma or heavy sleep. The very slight attacks consist in a momentary abeyance of the mental faculties—faints, forgets, the patients like to call them—sometimes with and sometimes without slight and partial convulsion. These extreme forms of epilepsy we judge to differ only in degree, inasmuch as they both attack the same persons at different times; or, the one form conducts to the other. Between these the gradations are innumerable. We call the extremes the *epileptic fit*, and the *epileptic vertigo*; the French name them the *grand-mal* and the *petit-mal.*

These *fits*, the spasmodic strugglings I mean, may last from a few seconds to two or three minutes. Paroxysms longer than this commonly consist of a succession of fits. Such a succession has been named the *status epilepticus.*

The fits recur at variable intervals; which are sometimes periodic, mostly irregular. There may be many in a single day; there may be only one for many years. They are commonly more severe in proportion as they are less frequent.

The epileptic seizures sometimes begin in early infancy: another period at which they are apt to commence is about the age of seven or eight: another about fourteen or sixteen, or for some few years after that age. They more frequently begin before puberty than after it. Sometimes the first fit takes place in the middle period of life: sometimes even in declining age. They often occur in the night, especially in the outset and towards the close of the disease; usually when the patient is between asleep and awake; *i.e.*, at the commencement or at the termination of his slumber.

In the majority, perhaps, of cases, the fit is unexpected, and preceded by no warning. But in other instances there is some alteration perceptible by the patient himself, or by his friends, giving notice of its approach; some change in his temper, feelings, appearance; some disturbance of his senses; ocular spectra; or what is called the epileptic aura, a creeping sensation arising in some part of the surface, generally of the extremities, and gliding towards the head. Some of these warnings precede the paroxysm by a day or two, or by a few hours; some by two or three seconds only. Sometimes the blow is threatened by their occurrence, but it does not fall.

The fit is always, in its severer forms, attended and followed by coma; sometimes, after the coma, by temporary confusion of mind; deafness; slight paralysis; delirium; inarticulate speech. These relics of the struggling fit seldom last many hours; but they may remain more or less manifest for some days. There is seldom any appreciable permanent damage effected by a single fit.

Repetitions of the fits lead, in a large majority of instances, first, to a defect of the memory, and of the general intelligence; and at length to a peculiar expression of countenance, to decided imbecility of mind, to complete fatuity; and with this there is often associated some paralysis or muscular debility.

The convulsions take place, necessarily, through the medium of the spinal cord and nerves—just as voluntary movements do; but the suspension of sensation, thought, and volition (which suspension is never absent, while the irregular muscular action often is wanting) shows that the *brain* is essentially involved in the disease.

Note, once more, both the kinship and the separate identity of these several nervous disorders. In apoplexy the nerve force is extinguished or eclipsed; in hemiplegia its passage along the motor tract is barred by disease; in epilepsy, or hemispasm, which is the counterpart and converse of hemiplegia, it is let loose from its natural and healthy restraints, and spends itself in wild, disorderly, explosive violence. Here the brain acts upon and through the spinal cord; in tetanus the spinal cord asserts its independent power to go wrong. The patient in hemiplegia is unable to move certain muscles; in hemispasm he is unable to restrain their movements. The explosion is believed to be preceded or initiated by sudden anæmia of the brain, the result of spasmodic contraction of the muscular fibres of its minute arteries. If I might vary the simile I used yesterday, and liken the epileptic paroxysm to the discharge of a loaded gun, I should say that the arterial spasm pulled the trigger.

Accidental organic lesions are sometimes (and sometimes only) found in the encephalon, or in the spinal cord, of persons who have suffered epilepsy uncomplicated with any permanent mental or paralytic affection; tumours, for example, or bony growths from the interior of the skull: but as these are *constant,* while the paroxysms are *occasional,* and as in the intervals they give no signal of their presence, we can only regard them as being probably predisposing causes of the seizures.

When the epilepsy *has* been complicated with permanent alienation of mind, or with some degree of paralysis, evidence of chronic inflammation of the brain and of its membranes is generally discoverable. This has been the consequence of the repetitions of the paroxysms. This explains the frequent connection of fatuity and palsy with epilepsy of long standing.

The diseased condition which is causative of the paroxysms may be situated in the nervous centres themselves, or in some other part of the body. In the one case we call the disorder centric, or idiopathic; in the other, eccentric, or sympathetic. We cannot always be sure with which species of the disease, the centric, or the eccentric, we have to deal: but the distinction, when it can be made, is of considerable importance, as regards the prognosis, and as regards the management of the case.

The predisposition to this fearful complaint is often hereditary. Malformation, or want of symmetry in the two sides of the head, is a frequent predisposing cause. So, pre-eminently, is the scrofulous diathesis. And these two, viz., the scrofulous diathesis, and a peculiar conformation of the head, are both liable and likely to be propagated from parents to children. But the predisposition is found to be hereditary even when the shape and structure of the body is, to all appearance, quite perfect and natural; and when no outward indication of the strumous diathesis is perceptible.

At the very close of the lecture I informed you that it is an unsettled question—and it is not a question of very great importance—whether the disease be more common in females or in males: whether the *sex* have anything to do with the predisposition. I do not think it has.

Taking epileptic people as a class, you will find them to be generally characterised by weakness and irritability of mind and body, and not by steadfastness and vigour; by a lack rather than an excess of vitality. They are much more commonly pale than florid, anæmic than plethoric, feeble than robust, melancholic than sanguine, timid than bold. And these indications of a low standard of vitality become still more manifest in those who have been long or frequently subject to the disorder. The inherent debility of the system augments as the paroxysms multiply in number.

There are certain vices, which are justly considered as influential in aggravating, and even in creating, a disposition to epilepsy: debauchery of all kinds; the habitual indulgence in intoxicating liquors; and, above all, the most powerful predisposing cause of any, not congenital, is masturbation—a vice which it is painful and difficult even to allude to in this manner, and still more difficult to make the subject of enquiry with a patient. But there is too much reason to be certain that *many* cases of epilepsy owe their origin to this wretched and degrading habit: and more than one or two patients have voluntarily confessed to me their conviction that they had thus brought upon themselves the epileptic paroxysms for which they sought my advice.

Among the *exciting causes* of epilepsy, fright is conspicuous. Any *strong mental emotion* is apt to produce the fit, in a person who is already subject or predisposed to the disease. In thirty-five out of sixty-seven cases, seen by Leuret, the first epileptic attack was preceded by a fright. You know how terror, especially sudden terror, will blanch the cheeks. It may have a corresponding effect sometimes upon the brain. This fact alone would be enough, I conceive, to forbid our ascribing the paroxysms exclusively to an affection of the spinal cord. Bodily pain; manifest and great disturbance of almost any of the principal functions of the body; may also act as exciting causes. Sometimes the cause is obvious, sometimes it is quite inscrutable. If the attack occur every night, Dr. Bright thinks it may be attributed to the 'congestion' of sleep: if it take place at monthly intervals in women, we may 'often trace it to nervous irritation in sympathy with the uterus: and when long periods have intervened we may usually trace each distant paroxysm to the repetition of some excess, or to a neglected state of the bowels.' In these latter cases, the epilepsy is of the sympathetic, or eccentric kind; the irritation being seated in some part at a distance from the nervous masses, in the stomach, or intestines, or uterus. Now I would suggest the expediency of observing what muscles or sets of muscles are *first affected* by the spasm in such cases, and in what part the warning aura (if there be any) arises: because by accurately noting these particulars, we may, perhaps, be led to a knowledge of the part or organ in which the irritation operates: and if we know the *seat* of the irritation, we shall be more likely to know its *nature*, and its *cure*.

Among the exciting causes of epileptic fits are also enumerated—and I believe, from what I have myself noticed, with great justness—the repulsion of eruptions, and especially of eruptions about the head, when proper artificial evacuations are not at the same time obtained; the cessation of habitual discharges; and, on the other hand, profuse and unusual discharges; large and sudden hæmorrhages. I have shown you that when animals are bled to death, they are always affected with convulsions before they expire.

There is yet another very singular occasional cause of epilepsy that deserves to be mentioned, viz., the sight of a person in a fit of that disease. This has been noticed over and over again. Not only will a patient who has already suffered such attacks often fall into one upon seeing another so affected; but people will even sometimes do so who have never before shown any symptom of epilepsy. In this way the disease will now and then run through a boarding-school; or through a ward in a hospital. There is a very good example of this recorded in the 11th volume of the 'Medical Gazette,' by Dr. Hardy, of Bath. A strong healthy young man was hired to take care of an older patient, who suffered frequent and exceedingly violent paroxysms of epilepsy. He remained with the patient night and day; and at the end of seven weeks became himself epileptic in a very high degree. An acquaintance of his, of equally robust make, but some years older, occasionally visited the two. In a fortnight from his first visit he also was seized with similarly violent attacks. Dr. Hardy quotes the following short case also from Baglivi:—'Vidimus, anno 1690, in Dalmatiâ juvenem gravissimis correptum convulsionibus, propterea quod inspexerat solummodo alium juvenem dum epilepsiâ humi contorquebatur.'

Dr. Cullen, who, as well as many others, had noticed the same thing, starts the question whether this mode of propagation of the disease be imputable to dread and horror; or to the mere force of imitation, which is often so strong, in health as well as in disease: and he decides in favour of the force of imitation. In fact, there are many other sights equally horrifying with that of a person in convulsions; yet there is *no spectacle* of horror so efficacious in producing a fit of epilepsy in others, as that of a person suffering under epilepsy.

This principle of imitation holds good in many of the spasmodic diseases: and in some of them, especially in hysteria, its influence is more remarkably seen than in epilepsy: I shall therefore have to recur to it again. There is one very curious fact, however, which relates to epilepsy in particular. You are aware that this disease is often feigned by impostors. Now I believe it is ascertained, beyond the possibility of doubt, that fits and actions which were at first, in these pretenders, strictly voluntary, have at length become involuntary and uncontrollable, and have passed into paroxysms of real epilepsy. The rogue is caught in his own trap.

And the mention of these impostors leads me to consider the *diagnosis* of epilepsy. First, how are we to distinguish the feigned disease from the true? Secondly, are there any other real diseases which may be mistaken for epilepsy, or for which epilepsy may be mistaken?

In the number of *feigned* diseases epilepsy is one of the most common. Soldiers and sailors in this country pretend to have epileptic fits, in the hope of obtaining their discharge from the service. In France the disease is often feigned in order to escape the conscription. Cases of simulated epilepsy occur also continually in our streets among mendicants and impostors, who think to excite the compassion and pecuniary charity of the credulous; and are even sometimes actuated, I believe, by a desire to obtain admission into hospitals, where they live tolerably well, and quite idly. It is easy enough, they think, to throw their legs and arms about, and to grin; and many of them get up a capital show of foaming at the mouth, by placing a bit of soap between the gums and cheek. The means of detecting these vagabonds are of some importance to us all; and it is more particularly necessary that they should be well known to those who are likely to join the medical department of our fleets or armies.

It is of course desirable, in questionable cases, to witness a fit. But pretenders are not very willing to perform when they know that a medical man is looking on. You may sometimes convict them, in the absence of the fits, by cross-examination. A cheat will seldom be consistent in the account which he gives of his fits; as to whether they are regular or irregular; and as to the times and places in which he has suffered them.

An impostor chooses such situations for his exhibition as are most suitable to his own purposes; a crowded street, or a well-frequented public walk. True epileptics almost always select retired places to take exercise in; especially if they have any warning or expectation of the approach of a paroxysm. You will find too that the impostor is not attacked at his own home; but always fixes upon some spot in which he is not only sure to be seen by others, but also not likely to sustain any injury by tumbling down. True epileptics are often seriously hurt by their falls; feigned ones generally come off without much bodily damage. However, when the fits are alleged to be frequent, and when also they occur regularly, you may soon expect one, and must make a point of being present; and then you will seldom fail to remove or to verify your suspicions. In the first place, the muscular power of epileptics is far beyond what is natural. It will sometimes take four or five stout men to hold a weak emaciated lad, in a fit of epilepsy. Of course no impostor can command more than his natural strength. In the second place, a real epileptic fit, if it last long, is seldom violent; whereas impostors, for obvious reasons, make their fits both long and violent. You may often get much information from the state of the eyes, which usually in true epilepsy are partly open, with the eye-ball visibly rolling and distorted. In feigned epilepsy the actor almost always prefers to shut his eyes completely. Sometimes, if he be closely watched, and no suspicion be expressed, he will be seen to open his eyes occasionally, to ascertain the effect of his exhibition upon the bystanders. In real epilepsy, too, the pupils are most commonly dilated, and do not contract when stimulated by light. This is a very sure criterion; for no impostor can prevent his iris from acting on exposure to vivid light. The pulse, in true epilepsy, is not only frequent, but often irregular also; a circumstance which never can be imitated. The skin of an epileptic, during the fit, is commonly cold; but that of an exhibitor is hot, and covered with sweat, obviously the consequence of his violent and voluntary exertions. In this respect, also, it is scarcely possible for him to deceive us. Again, an impostor will not bite his tongue, as epileptics often do; nor very willingly void (like them) his excrements and urine during the fit; indeed, it would not be very easy for him to do so, and at the same time to carry on the necessary pretence of convulsions. Besides, epileptics, during a fit, are quite insensible to external impressions; and hence the vulgar modes of detection, though harsh and not to be recommended, are often effectual ones; such as dropping melted sealing-wax upon the patient; putting some gin into his eye; burning him with a hot poker; or (what I believe is more fashionable among beadles and police constables, when they have to administer to such patients) the pressing your thumb-nail violently under that of the supposed impostor. This causes exquisite pain, yet inflicts no lasting or serious injury; and I believe that few malingerers stand out against this expedient. It is astonishing, however, how much torture some of them will bear before they can be brought to confess their imposition. If we speak of having recourse to some of these painful tests in the hearing of the pretender, we shall find that the fit will soon come to an end. Dr. Cheyne mentions an instance in which one table was placed upon another, and a soldier, who was supposed to be shamming, was laid upon the upper one, while his paroxysm was on him; and the fear of falling from such a height soon stopped the convulsions. Mr. C. Hutchinson relates the case of a sailor who was suspected to be a cheat, in whom the convulsions were instantly removed by blowing some fine Scotch snuff up his nostrils through a quill. This brought on *another* kind of fit, viz., a fit of *sneezing*, which lasted nearly half an hour; and there was no return of the epilepsy so long as Mr. Hutchinson remained in that ship. He tried the same expedient in cases of *real* epilepsy, but never could produce any similar effects, although the patients were not snuff-takers. There was a beggar in Paris, who often fell into epileptic fits in the streets; one day some compassionate spectators, fearing that he might injure himself in his struggles, got a truss of straw and placed him upon it: but when he was in the height of his paroxysm, and performing remarkably well, they set fire to the straw; and he presently took to his heels.

There is another ingenious plan, very likely, I should think, to detect an impostor, and yet not calculated, like the one last mentioned, to injure a real sufferer: which is to propose gravely, in his hearing, to pour *boiling* water upon his legs, and then to proceed actually to pour *cold* water upon them.

Of the *real* diseases which are apt to be confounded with epilepsy, *hysteria* is the chief. The question whether a given case be one of epilepsy or of hysteria, very often arises. By a careful attention to several circumstances, the discrimination is generally to be made. In the first place, the total suspension of consciousness, which is so constant an accompaniment of the epileptic paroxysm, does not take place in the hysterical. In epilepsy there is no globus hystericus, no alternations of laughter and tears. The solitary cry which ushers in the epileptic attack so frequently, and which is so characteristic, is not heard in hysteria. Not that hysterical girls do not scream, for they often do; but then it is repeatedly and continuously. The heavy comatose sleep that succeeds epilepsy is not common in hysteria. Hysterical patients contrive also to avoid hurting themselves by their contortions: they do not bite their tongues, nor foam at the mouth. Dr. M. Hall teaches that, in epilepsy, there is a forcible closure of the larynx, and expiratory efforts which suffuse the countenance, and probably congest the brain, with venous blood. In hysteria the respiration, on the contrary, is rapid and sobbing.

It is interesting to remark how early and how strongly the muscles that lie about the throat are implicated, in each of the three terrible spasmodic disorders which we have been contemplating. Tetanus begins with cramp in the muscles of the back part of the neck, and of the lower jaw. The pharyngeal muscles, as well as those subservient to respiration, are intimately concerned in the paroxysms of hydrophobia. In epilepsy it is Dr. Hall's belief that the platysma myöides plays an important part, preceding often, in spasmodic contraction, the muscles that shut up the larynx, compressing the jugular and other veins of the neck, and so producing congestion of the parts within the cranium. In all three the stress of the malady is first visible in muscles which obey the influence of the medulla oblongata, or of the upper portion of the spinal cord.

Observe that I have been speaking, all along, of what may be called *ordinary* epilepsy: epilepsy in its commonest form, belonging somehow to the constitution of the patient: idiopathic. It is not every attack of convulsions with insensibility which ought to be so named. Such attacks are apt to follow sudden injuries done to the brain; stunning blows on the head, fractures of the skull, the eruption of blood in cerebral hæmorrhage, and even overwhelming emotions of the mind. The retention of urea in the unpurified blood, occurring in connection with a peculiar renal disease which I have frequently alluded to already, and which I shall hereafter describe, is a frequent cause of similar seizures. They happen also in parturient women, in persons poisoned by lead, or by the syphilitic virus, in hydrocephalic patients, in persons affected with hypertrophy of the brain, and in the outburst of some of the eruptive fevers. Between these casual occurrences, as they may be reckoned, of epileptiform convulsions and ordinary epilepsy, we must carefully distinguish, when we can; for each case may demand its own peculiar kind of treatment. But the desired distinction cannot always be made.

Epilepsy is one of those complaints concerning the *probable issue* of which the patient, and still more the patient's friends, are sure to make repeated and anxious enquiries. It is seldom that we can pronounce with any confidence a favourable prognosis; but there are some cases in which the prospect is much worse than in others.

If we have reason to believe that the disease is *centric*, and connected with some organic flaw in the nervous centres themselves, the prognosis must be bad. *Cæteris paribus*, it is rendered worse by the coexistence of any sign of scrofulous disease, or of the well-known bodily characteristics of the scrofulous diathesis: it is worse, also, when the disease has happened in the parents, or among the more immediate ancestors, of the patient; whenever, in short, there is reason to think the disposition to it is inherited. The prognosis is bad when the complaint occurs in persons who have slanting foreheads and misshapen skulls; and when the epileptic physiognomy has become established. The prognosis is always the more unfavourable the longer the disorder has lasted; the oftener the fits have been repeated; and the more habitual they have become. And when the memory is permanently enfeebled, or fatuity has come on, or the disease is complicated with any form or degree of paralysis, the case is hopeless; so far, at least, as a perfect cure is concerned. Dr. Jackson, of Boston, U.S., in his 'Letters to a Young Physician,' says, 'I believe that no patient has recovered from the epilepsy, in whom I have seen it associated with these *slight turns*,' or *faint turns*, as he elsewhere terms them. The *petit mal* in fact.

On the other hand, the prognosis is better when the disease is *eccentric: i. e.* when there is any obvious exciting cause of the paroxysms, manifest in structural or functional disorder of some part of the body other than the nervous matter. And when this eccentric cause is removable—a stone in the bladder for instance, worms in the intestines—some poison that has got into the system, and is capable of being expelled—then the prognosis still further improves. On this account the prognosis is better in children than in older persons, for the exciting cause is often clearly eccentric, and likely to be transitory; the irritation of teething for example; and besides this, it is stated by many practical writers that even repeated and habitual attacks of epilepsy in children often go off as the patients grow older, and especially at the age of puberty. The experience of Heberden, however, was against this. He says that he had known several persons *become* epileptic at that time; but that he had never met with one who had *then* got rid of the disease. He had seen a few who had recovered before, and some after, the age of puberty. Dr. Elliotson mentions a case in which a girl had epilepsy prior to the first period of menstruation: then the fits stopped; and she remained free from them until in advanced life the catamenia ceased to recur; and then the epilepsy returned. In all those cases in which we can assign some evident cause for the fit—such as the use of improper food, uterine irritation, mental emotion, and so forth—the prognosis is somewhat better than usual. 'The eccentric epilepsy (says Dr. Hall) is to be viewed as *curable*, however *difficult* of cure.' And however unfavourable the prognosis may be, there is nothing that can excuse any apathy or neglect on the part of the practitioner. Though few cases of ordinary epilepsy admit of a *cure* under any treatment, yet there are few which may not be *relieved* by treatment, so far as regards the *frequency* or the *violence* of the fits, or *both.*

The *treatment* of epilepsy resolves itself into the measures to be adopted during the fit; and the measures to be adopted during the intervals between the fits.

In the paroxysm itself we have to provide against the risk of injury from the struggles and contortions of the patient; and, if possible, to mitigate the violence, and to shorten the duration of the fit. The patient should be placed in the centre of a large bed; his neckcloth, and any ligatures about his person, should be loosened; his head should be somewhat elevated. When the risk of his hurting himself cannot be avoided in any other way, his limbs should be restrained by the bystanders, or somehow secured. Some persons have advised that a piece of cork, or india-rubber, or soft wood should be placed between his teeth, to prevent him from biting his tongue, or breaking his teeth. But it is not easy to manage this expedient cleverly. If the head be visibly congested and hot, cloths wetted with cold water may be applied to it; and if, at the same time, the extremities be cold, means of restoring warmth to them should be adopted. Very seldom, during the fit, can any bleeding be necessary or proper; unless, indeed, the venous congestion should become so extreme and threatening as to seem to demand that kind of relief: and even then I should advise you to do no more than take a small quantity of blood, by cupping, from the neck or temples. Generally the convulsions and the sopor may be expected to pass away soon—as soon, probably, and as completely, without as with any abstraction of blood. Certainly all risk should be avoided of worsening the after-condition of such patients.

It is now an ascertained fact that the violence of the convulsive struggles may with certainty be calmed, and their duration shortened, by the inhalation of the vapour of chloroform: a fact in perfect harmony with the experience of MM. Kussmaul and Tenner, who found that in animals under the influence of an anæsthetic vapour convulsions were *not* produced by sudden and mortal hæmorrhage, or by ligature of the cerebral arteries. This expedient would seem especially suitable for that continuous and long-drawn chain of fits which constitutes the *Status Epilepticus*.

It has, however, been made a question, whether it is better, so far as the after-state of the patient is concerned, to control and stop a fit by chloroform, or to let it have its free course. It has been alleged that subsequent fits are apt to be more intense in consequence of this check. I have seen no proof of that, and since each successive violent struggle leaves probably some fresh and permanent damage behind it, I should, in severe cases, encourage the quieting use of chloroform.

During the intervals between the attacks we seek to prevent their recurrence; and this end is to be attained, when it is attainable at all, by getting rid of the predisposition to the disease on the one hand, and by protecting the patient against its exciting causes on the other. Now there are certain kinds and causes of predisposition which we *cannot* get rid of; such are the tendency that is *inherited*; the strumous diathesis; malformation of the head; the presence of some organic lesion in the brain or spinal cord. Vicious and dissolute habits are also difficult, but not impossible, to eradicate. It will be our duty when such are discovered, to set strongly before the unhappy patient the dreadful end towards which he is hastening; the certain loss of reason to which, when once the disease has shown itself, the continuance of his baneful indulgences will drive him; and to urge upon him the necessity for a short and sudden turn on his part, if he would expect any aid from medicine. In all cases we must seek to give stability and firmness to the nervous system; to diminish that mobility, or readiness to be impressed, which is so strong a characteristic of the class of patients affected with epilepsy, although it may not be very apparent in some few individuals among them.

One of the most useful of the particular remedies employed for strengthening the body, is the cold shower-bath, or the cold spunging bath. Either of these tends more perhaps than any single measure, to give permanent firmness and steadiness to the system. The best test, in all cases, of the tonic and bracing effect of this remedy is the occurrence of a pleasant and general glow after each application of it. These are the only safe modes in which a cold bath can be used by an epileptic person.

There can be no doubt that convulsive fits, not distinguishable in their phenomena from ordinary epileptic fits, are not unfrequently the results, especially among the lower classes, of syphilitic disease in the bones of the skull, or in the membranes of the brain, or even in its substance. In every case, therefore, of epilepsy that may come before you, you must search carefully for some history of past, or for some evidence of present syphilis; and if you find these, or either of them, you will found your treatment upon the knowledge so acquired. Give the iodide of potassium a sufficient trial; or a mild but long-continued course of mercury, keeping always within the limit of actual salivation.

Similar fits are not uncommon in the advanced stages of Bright's disease. If you find other tokens of the presence of that disease, the treatment of the convulsive symptoms will merge in that of the compound affection.

Painful or irregular dentition is perhaps one of the commonest of the eccentric sources of epilepsy. Sometimes the attacks are attended with symptoms of disease in the liver; slight yellowness of the skin, uneasiness and tenderness in the right hypochondrium, and lowness of spirits. In such a case we must rectify that state of the liver, by such means as I shall have to specify hereafter. If the disorder depend on a calculus in the urinary organs, the cure must be committed to the surgeon. I long had a patient under my occasional inspection, who from time to time suffered slight fits of epilepsy: on most occasions he passed about the same time a small stone by the urethra. I make no doubt that in his case the exciting cause of the epilepsy lay in the kidney.

The fits may depend upon uterine irritation which must always, when women are the subjects of them, be enquired after, but upon which I am not competent to give you instruction.

Intestinal worms, again, may be at the bottom of the attacks, and then turpentine, or some other vermicide, will be the appropriate remedy. The occasional efficacy of turpentine in curing epilepsy was first made known, I believe, by Dr. John Latham. Foville states that he has seen excellent effects from it. It is highly spoken of by Dr. Percival, in the Dublin Hospital Reports. Its success has been due probably to its anthelmintic properties. A former President of the College of Physicians cured a case of epilepsy in this way, somewhat to his own surprise. Without having in his mind any notion of worms, he thought it might be well to purge his patient, who had laboured under epilepsy for some time, with the oleum terebinthinæ. The patient, a man of some mark in the State, was residing two or three miles out of town. In the middle of the night the doctor was summoned to him in a great hurry; the messenger said he was supposed to be dying. He was only intoxicated, however, by the free dose of turpentine he had swallowed: the next morning he voided into the close-stool a large tape-worm; and he never had epilepsy afterwards. A nobleman residing in Cambridgeshire was long epileptic; and he too got rid of his epilepsy and of a worm at the same time. I believe that the cure was effected by turpentine in his instance also; but I am not certain of that. Such cases are remarkably interesting: they show that irritation of the stomach or intestines may be sufficient to cause the fits; they illustrate excellently well the eccentric form of the disease; and they deserve to be always borne in mind when we are asked to prescribe for an epileptic patient. A cure from so dreadful a complaint, by means so simple—the cause of his malady, and the certainty of his having got rid of that cause, being both so obvious and intelligible to the patient—may be enough, sometimes, to make a practitioner's fortune.

Should no physical eccentric cause of the proclivity to epileptic fits be detected capable of being removed, we turn to the method of treatment in ordinary epilepsy: and prior to the selection of any particular remedy, there are certain other points in the management of the disease which are of essential importance. The patient who is subject to epilepsy should live by rule, and be temperate in all things. His diet should be simple, nutritious, but not stimulating. Under special circumstances, it may be advisable that he should renounce all strong liquor, and become, in the new-fangled and vulgar phrase, a tee-totaller. He should rise early, and take regular exercise in the open air; keeping his head cool, and his extremities warm. He should avoid all mental excitement, and the fatiguing pursuit of what is called pleasure; all probable sources of sudden anger, surprise, alarm, or deep emotion of any kind; all striving and contention of the intellect. The student, of whatever age and sort, in whom epilepsy has declared itself, should shut his books; the man of business abandon or abridge his professional toil: at least they must be instructed to abstain habitually, in their respective callings, from such application as would task and strain their powers, whether mental or bodily; and endeavours should be made to engage their thoughts and to interest their minds in less engrossing objects of attention, and thus to avert the opposite deteriorating influence of utter vacuity. No minute rules can be laid down on these points, but, keeping the general indication in view, it will seldom be difficult to follow it up in practice.

When the fits appear to have been brought on by a species of moral contagion, or by imitation of the same disease seen in others, care should be taken to exclude as much as possible those objects or trains of thought which produce the mental emotion or the morbid propensity.

The drug which is most eminently and most surely serviceable as a remedy for epilepsy—diminishing the frequency and the severity of the fits, and sometimes perhaps abolishing them for ever—is one of quite recent use for that purpose: I mean the bromide of potassium. Like that of all other drugs, its special virtue was discovered empirically, and could never have been reasoned out. We owe our knowledge of its value and efficacy in this disease to the experience of Sir Charles Locock. Sufficient time has not yet elapsed for testing the permanence of its curative influence, but there really seems ground for hoping that over ordinary epilepsy, when there is no invincible impediment to complete recovery, the bromide may exercise a controlling power as specific, as quinine is well known to possess over attacks of ague.

The bromide should be given in considerable doses—from ten grains to a scruple or half a drachm thrice daily—and for a considerable time. Its continued use in this manner is seldom productive of any ill effect. In some few persons it has been followed by a vesicular itching eruption on the skin: in others it has caused some feeling of faintness—a feeling which may be prevented by the addition of tincture of bark, or of some diffusible stimulus, such as the spirit of chloroform, to each dose of the remedy.

Certainly the drug exerts a tranquillising influence upon the nervous system: and it is believed to blunt the sensibility of the mucous membranes in particular. It will often procure sleep when direct opiates fail, or are ill borne.

But though it is the first that should be tried, this remedy is not infallible: and even in cases in which it has been found beneficial, its virtue has sometimes seemed to wear out. It is right, therefore, that you should know what other drugs have heretofore found favour with physicians against attacks of ordinary epilepsy.

You will find that many medicines, chiefly of a tonic character, have been much recommended. Of the mineral tonics, the salts of silver, zinc, copper, and iron, have been chiefly praised. The nitrate of silver used to be highly thought of; but there is one very serious objection to it which must never be forgotten: viz. that it is apt to produce a permanent discoloration of the skin, a frightful lead-colour. There was formerly a footman in a house near my own who had been thus blackened: and there was, and may still be, a gentleman of property resident at Brighton in the same predicament; his face looked as if it had been thoroughly and carefully pencilled over with plumbago. A barrister, a friend of my own, had a narrow escape from a similar misfortune: in fact his skin has acquired a just perceptible tinge of gray. Now if the remedy were sure to cure the disease, I am not certain that every one would accept of a cure on such terms. It would be proper, even on that supposition, to tell the patient that though he (or, *a fortiori*, she) would get rid of the epilepsy, there was a likelihood that this unamiable complexion might ensue. But the truth is that in giving this nitrate of silver we run a great risk of obtaining its disfiguring effect, for the sake of a very small chance of curing the epilepsy. I was assured, by one of his friends, that the Brighton gentleman had carried a dark outside for a quarter of a century at least; and that he was then as subject to epileptic fits as ever he had been. To do good, the lunar caustic must be given for some time together, and the probability is that it will not do good even then: and if it be given for some time together, there is great danger of its changing the colour of the skin. For these reasons I have never given it myself, and therefore I cannot recommend it to you. If you wish to try it, or if you have a patient who insists on trying it, as some will, you may begin with half a grain, in a pill, three times a day; and the dose has sometimes been carried as high as fifteen grains. And it is worth observing that in the larger doses this drug proves purgative. It is possible that its good effect, when it has any, may be attributable to its operation in that way.

There is no danger of spoiling the beauty of your patient by administering the oxide or the sulphate of zinc; or the cuprum ammoniatum. The liquor arsenicalis has been thought useful; but it requires to be given with great caution. Of all the metallic remedies I should prefer some preparation of zinc, or of iron. They appear to do good by giving what is called tone to the nervous system, and rendering it less prone to be affected by the slighter exciting causes of the disease. The salts of iron probably do this by improving the condition of the blood. I cannot pretend to weigh the merits of the long list of substances which have been lauded as efficacious in keeping off and curing the disease; and which, when they have been useful at all, have operated, I conclude, in diminishing the disposition to epilepsy, by corroborating or by soothing the nervous system. The most renowned of them are valerian, asafœtida, wormwood, the mistletoe of the oak, the cardamine pratensis, the galium album, rue, the cotyledon umbilicus, the sedum acre, indigo; narcotic vegetable preparations, stramonium, belladonna, hemlock, lettuce; animal substances, musk, castor, ox-gall; and the number might be many times multiplied. This long array of drugs, all of which have been known, or supposed, to accomplish a cure, affords, in truth, one of the strongest evidences of the intractability of the disease under almost any plan of treatment. There is a shrewd remark of Esquirol's, which I believe to be quite true, however difficult it may be to account for the fact, and which is, that epileptics are apt to improve for a time under every new plan of treatment.

Surgical remedies have been proposed, and practised—castration in the one sex, clitoridectomy, as it is called, in the other—on the principle, I suppose, of removing eccentric sources of excitement of the nervous system. If I speak of these operations at all, it is only to condemn and denounce them. There is no *primâ facie* objection to counter irritation; to the use of the croton oil liniment, of blisters, of a seton in the neck. But I must confess to you that, often as this expedient is employed, I have seldom witnessed any such result from it as would encourage me to expect benefit from repeating it in another case.

Dr. Quain, in his edition of 'Martinet's Pathology,' relates the following case:—'Some years ago I saw a boy who was epileptic from infancy, and who, in one of his usual fits, fell over a cliff by the sea side, and received a very severe lacerated wound of the scalp, which healed slowly and with a copious suppuration. While the discharge continued he was free from any epileptic attack; but as soon as the wound healed, the fits returned as before.'

Twice I have seen similar good effects from the insertion of a seton in the neck. Twenty times that measure has disappointed my hopes.

When the patient has a distinct warning of an approaching paroxysm, can anything be done to ward it off? Why, in some cases, by interrupting the precursory symptoms, it certainly may be prevented. A pupil of the class informs me that a brother of his, twelve or thirteen years old, has been subject to epileptic fits for two years. They occur in the night, especially if he be waked, even though the awakening cause may have no tendency to startle him. He often is dull and drowsy the evening before, and if his friends rouse him from this lethargic state by conversation or amusements, the attack expected that night sometimes does not happen. Another student knows a young girl, in whom the occurrence of very high spirits is always precursory of the paroxysm. When this extreme vivacity is moderated by those about her, the threatened fit is sometimes averted. I mentioned before an instance in which the aura, proceeding from one of the thumbs, was frequently checked by tying a ligature tightly round the thumb. Other examples of exactly the same kind are on record. Mr. Wardrop cured a case beginning with an aura in one finger, by amputating a joint of the finger. Dr. M. Hall states that the immediate accession of the paroxysm may sometimes be prevented by dashing cold water on the face, or by exciting the nostrils by snuff. In this manner the disposition to closure of the larynx, and to expiratory efforts, is exchanged for sudden acts of inspiration. Another patient of my own, an old college friend indeed, who is afflicted with epilepsy, feels convinced that he sometimes staves off a fit by applying smelling salts to his nose: and he always carries a bottle about with him for that purpose; but unfortunately the warning (which consists chiefly in giddiness) is often so short, that he has not time to have recourse to his preventive before he falls down. It is a question whether the fit may not be obviated by a strong mental effort in some cases. I believe that it may, especially in the imitative form of the disease, which originates in, and depends upon, mental and moral causes.

It is scarcely necessary that I should do more than advert generally to those precautions which everyone who is subject to epilepsy ought to observe, and which it is the business of his medical adviser to enforce, both upon the patient himself, and upon his friends. His bed should be large, and low; or if not large, it should be enclosed with some netting or other defence against his falling out of it. If he sleep in a room by himself, care should be taken that in the winter a proper temperature is kept up, for should he get out of bed in an attack, and remain upon the floor, he may be seriously injured by cold. He should not, however, be left alone if it can be helped. Guards should be placed over every fire-grate near which the patient may come. He should avoid ascending and descending stairs as much as he can. He should not ride on horseback; nor on the outside of a carriage; nor even in a gig; nor go about, especially in solitary places, without an attendant. A patient of Dr. Cheyne's, a young man of twenty, was drowned in his own garden by falling forwards into a little runnel of water, which was not four inches deep. Neither, on the other hand, will it be proper or safe for him to frequent crowded or hot rooms; or the streets of a populous town, in which the multiplicity and distraction of objects are apt to produce, even in a healthy person who is not accustomed to them, a degree of vertigo and confusion. Dr. Cheyne advises that when the patient's circumstances will admit of his having a constant attendant with him, the latter should be provided with some diffusible stimulus: a potion, for example, composed of camphor mixture and ten minims of the *eau de luce*, by the swallowing of which the impending paroxysm may sometimes be repelled.

LECTURE XXXII.

Chorea. Symptoms; Pathology; Complications; Causes; Treatment. Chronic Chorea. Other Nervous Disorders to which the same name has been applied. Loco-motor Ataxy. Its symptoms, pathology, and treatment.

Another disorder of a spasmodic kind, and essentially belonging to the nervous system, is *Chorea—St. Vitus's dance.* This, in its ordinary form, is far less serious than the diseases which we have recently been considering; but it is always a most distressful complaint to suffer, and occasionally it assumes a very frightful and even a fatal form. It has several points of analogy with the other nervous and spasmodic ailments. Its prominent symptom is an irregular and involuntary clonic contraction of some of the voluntary muscles, which, however, are not wholly or constantly withdrawn from the government of the will. In tetanus we had rigid spasm, while the mind was clear and free; volition was unaffected, but the muscles which should have obeyed the effort of the will, were seized upon and mastered by some stronger overruling power. In epilepsy, with both tonic and convulsive spasm there was suspension of the mental functions: a temporary interruption of consciousness, and therefore of volition. But in Chorea we have a different state from either of these. There is no loss of consciousness; no defect of volition. The ordinary movements of the body can be performed in some degree, or sometimes, under the bidding of the will; but it would seem as if some other power, thwarting the will, wantonly interfered to excite them when they are not needed, to render them unsteady and imperfect, to arrest the natural movement, to give a new and false direction to the limbs, and to cause the patient to gesticulate and grimace like a Merry-Andrew. Moreover, these apparently absurd motions do not occur in paroxysms, but continue throughout the day, sometimes for weeks together; but they generally cease during sleep: for the most part, but not always, the agitated limbs are still, while the senses are shut up in slumber. The complaint is not attended with *fever.*

This disorder was first distinctly described by Sydenham, whose account of it is very graphic and excellent, and has been copied by most subsequent writers. Without reference, however, to the portrait which he has left us, I will sketch the disease, as it has occurred under my own observation. It usually begins with slight twitches of a few muscles in the face, or in one of the upper limbs; and by degrees the spasmodic action becomes more decided and more general. All the voluntary muscles are liable to be affected by it. Those of the face seldom escape. The features are twisted into all forms of ridiculous expression; you might suppose that the patient was what is called pulling a face, or making mouths at you: but there is neither mirth nor mockery in the contortion; it is a little convulsion. It is succeeded by a vacant look, and then it begins afresh. The disease occurs much oftener in young girls than in any other persons. If you ask the patient to put out her tongue, she makes sundry attempts to do so before she can accomplish it; and then the tongue is suddenly thrust out, and as suddenly withdrawn, and the jaws snap together as if she were resolved that you should have as short a glimpse of it as possible. She writhes and contorts her shoulders. She cannot keep her hand or arm for half a minute in the same position. Alternating movements are common. The hand is turned palm upwards upon her lap, and presently reversed; the fingers are extended, and again bent; the eyebrows contract and expand; the mouth is opened and closed without apparent purpose. When, at meals, she desires to carry her hand to her mouth, it is arrested midway, and suddenly pulled back again, or pushed off in some other direction; and it is only after many deviations and fruitless efforts that she succeeds. The lower limbs are apt to be affected in a similar manner. When the patient intends to sit or stand still, her feet scrape and shuffle on the floor, or one of them is suddenly everted and then twisted inwards, or perhaps is thrown across the other; and if she endeavour to walk, her progress is indirect and uncertain; she halts and drags her leg rather than lifts it up, and advances with a rushing or jumping motion by fits and starts. In short, the voluntary muscles are moved in that capricious and fantastic way in which we could fancy they might be moved if some invisible mischievous being, some Puck or Robin Goodfellow, were behind the patient, and prompted the discordant gestures. With all this the articulation is impeded: there is the same perverse interference with some of the muscles concerned in the utterance of the voice. By a strong figure of speech, the disorder has been called ‘insanity of the muscles.’

I may here explain to you, briefly, an ingenious theory, out of which this expression has arisen.

It is held by many modern physiologists, as I have told you before, that one of the functions, the principal function indeed, of the *cerebellum*, is to preside over and regulate the faculty of locomotion; to keep the muscles in due subordination, as it were, to the will. No voluntary movement, almost, can be executed without the combined and consenting action of many muscles: it is the business of the cerebellum (they say) to maintain this consent and community of purpose; to prevent any mutiny of individual muscles, and to make them co-operate unanimously in producing an intended movement. How far this doctrine may be true I do not now pronounce or enquire; but supposing it well founded, then the cerebellum has been very ingeniously assigned as the seat of that change, whatever it is, which gives rise to the phenomena of chorea. And certainly the irregular movements by which chorea is characterised can neither be considered as the effects of imperfect paralysis, as some have stated, nor of convulsion, in the strictest sense of that word, as others have asserted; but rather as consequences of the want of due harmony and agreement between the various muscles, which should combine to produce the desired state either of rest or of motion. The requisite association in the actions of the different muscles is defective. A certain portion of the encephalon ministers to the intellectual functions; certain altered states of that portion lead to mental aberration; the persons thus affected form false judgments; cannot associate their ideas aright. So also a certain portion of the encephalon presides over the locomotive functions; and there are altered states of *that* portion, which lead to a loss of the due association of the muscular contractions; to *insanity* of the muscles. That portion is the cerebellum. Such is the theory—plausible and pleasant, but unsatisfying withal, and in my judgment—in so far at least as it relates to *Chorea*—unsound. What I believe to be a truer pathology will appear as we proceed.

Before I pursue in further detail the history of chorea, I would direct your attention to two instructive statistical digests of a large number of cases of the disease, as seen in hospital practice: the one drawn up by the late Dr. Hughes, and recorded in the fourth volume of 'Guy's Hospital Reports;' the other collected from the wards and case books of St. George's Hospital, by Dr. John W. Ogle, and published in the second volume of the 'British and Foreign Review,' for 1868. While I am considering various points of interest connected with chorea, I shall make frequent use of these two papers, for verifying or correcting the current doctrines concerning it. They both extend over a period of several years. Dr. Hughes' report includes 309 cases of the disorder, Dr. Ogle's 96; the whole number being, therefore, 405.

In addition to the picture which I have drawn of this strange malady, you will find that the jactitations are usually more marked and extensive on one side of the body than on the other: and sometimes they are strictly unilateral. Thus, in Dr. Ogle's list of 80 cases not fatal, there are 24 instances in which the right side only, and twenty in which the left only, was affected. In 25 both sides were implicated; but in some of these one side was more affected than the other. Among 97 cases observed by Dr. Russell, of Birmingham, the choreic movements were unilateral in 29, the right side alone being affected in 18, the left alone in 11. In 68 patients the jactitations were bilateral—chiefly on the right side in 18, chiefly on the left in 15, on both sides alike in 30. He noted also that in a large majority of instances the disorder *begins* unilaterally, and remains unilateral for a distinct, and occasionally a considerable period of time. Of 54 cases the movements occurred on both sides at once from the first in 11 only; in 43 they begun distinctly on one side or the other; becoming finally bilateral in 22, and remaining confined to one side only in 21.

In this feature of one-sidedness, so seldom entirely absent, is plainly revealed the affinity of the disease with epileptic hemispasm and with hemiplegia; while in those cases in which the movements are more marked and general on one side than on the other, we have fresh illustrations of Dr. Broadbent's theory. Again, the irregular movements of the limbs almost always appear first, and are most pronounced in the upper extremities; sometimes the lower limbs are not affected at all: they are never exclusively affected; and when affected they are the first to recover. Here again crops out the family likeness. It is a remark of Dr. Russell's that the movements affect the parts generally supposed to be dominated by the corpus striatum, and they affect them in the same order and degree as in ordinary hemiplegia. Generally speaking, the disease is the more severe, and the more difficult of cure, in proportion to its extent, *i.e.*, to the number of muscles implicated. I believe that in every fatal case hitherto recorded, the muscles of the whole body have been involved. It is a curious fact, but one which I have often verified for myself, that when one limb alone happens to be thus agitated, if that limb be laid hold of, and kept still by main force, some other limb or part will take on the spasmodic action. The persons who are subject to chorea are always inordinately sensitive, and what is popularly called 'nervous.' They are easily stirred by new ideas and sudden feelings, and pass readily, and upon slight occasions, from one mood of mind to another. The mind is affected, as Dr. Cullen remarks, in the same way, and often shows the same varied, desultory, and causeless emotions, as in hysteria. You see the indication of this nervousness in the fact that the fidgety catching of the muscles increases when the patient is spoken to, especially by a stranger—by the physician, for example. The nurses of the hospital constantly tell me that such or such a patient, who has chorea, is much more composed at other times than she is during my visits, when she is surrounded by students, and made the object of their attention. In most cases the jactitations are partly and in some degree under the influence of the will. Sometimes the patient seems to give way to them, indulges in or exaggerates them: at other times she can, by making an effort, control them. Many of the patients, especially such as are old and intelligent enough to understand our directions, and to make the trial fairly, can suspend for some seconds the convulsive movements, by taking a deep inspiration, and resting upon it, without expiring, for a little while.

The one-sided character on which I have dwelt has an important bearing upon the pathology of chorea: for it shows at least *this*—that the same region of the brain is concerned, directly or indirectly, in that disease, in hemiplegia, and in epileptic hemispasm; the region, namely, which includes the corpus striatum, the optic thalamus, and the structures adjacent. Occasionally hemichorea runs into hemiplegia; and, conversely, hemiplegia is occasionally accompanied by choreiform movements, and it even *improves* sometimes into chorea. Again, the same muscles are affected in hemispasm as in hemichorea: and if, as has been appositely said, chorea be 'next door to palsy,' it is as near a neighbour to epilepsy also.

Chorea, in its standard form, as I have endeavoured to describe it, is essentially a disease of youth. Sydenham, and Cullen, who closely follows him, state that for the most part it attacks boys and girls, who have not reached the time of puberty; between the tenth and fourteenth years of their age.

These limits are, however, too narrow. It is very common between the eighth and sixteenth years; a period which corresponds pretty accurately with that included between the second dentition and puberty. The disorder sometimes comes on as early as four or five; and now and then it begins in adult life, or in old age: the instances, however, in which a first attack occurs before the age of eight, or after the age of twenty, are comparatively few in number. Eleven was the age at which, in Dr. Ogle's list, the greatest number were affected. I have already intimated that chorea is much more frequent in girls than in boys. Taking the aggregate of Dr. Hughes' lists, of Dr. Ogle's, and of six others recorded by various observers, I find that among 1125 patients affected with this malady, 754 were females. This gives a proportion of nearly five to two. Of *fatal* cases, reported to the Registrar General during seven years (with one exception, consecutive years) there were 283 in females, 116 in males, giving very nearly the same ratio. Yet, according to the tabular statements of Dr. Hughes and of others, the two sexes are equally liable to chorea before the age of nine. If I may trust to my own experience, it is much more common in children having dark hair and eyes, than in those of a light complexion; and I think I have seen the same remark in some book, but I forget where. Temperature appears to influence its development. Dr. Hughes found it to be more frequent in the six winter months (reckoning October as the first) than in the six summer months, in the ratio of three to two. This tallies with Romberg's remark, that the disease becomes rarer as we approach the equator, and is almost unknown in the tropics.

When the disease is strongly marked, or lasts long, there is usually some imbecility of mind manifested; a slight degree of fatuity, and a foolish and often a sad expression of the features. But this goes off with the other symptoms. The child generally recovers, but the malady is apt to recur, and that more than once. In this respect we may trace another distant resemblance to epilepsy: if we regard each attack as a long and mild paroxysm, then these paroxysms are liable to repetition. No doubt the duration of the disorder is often abbreviated by proper treatment: there are *cures* in this disease as well as *recoveries*.

In its milder form, which fortunately is by much the most frequent form also, the grimaces and gesticulations of the patient are apt to be regarded, by thoughtless lookers-on, as objects of mirth and amusement; but in its severer and fatal form there are few diseases more terrible to witness. Sleep is obtained with difficulty; and in the waking state no intervals of calm arrive, such as divide the fearful paroxysms of tetanus, and of hydrophobia. In spite of all care and protective contrivance, the loins, hips, neck, and elbows of the unhappy patient are chafed and inflamed under unceasing friction with the bed-clothes; the limbs, in their perpetual contortions, are bruised and wounded; the bitten lips bleed and become fissured; the teeth are even forced out of their sockets; the countenance Dr. Hughes describes as wearing a piteous and imploring expression; occasionally an involuntary cry or squeak is heard, until at length the vital power is exhausted, and death comes to the sufferer's relief.

It is my good fortune never to have had a fatal case of chorea to treat, and I have seen but one. The subject of it was the patient of one of my colleagues, in the Middlesex Hospital. Under any circumstances, death from this disorder is uncommon: it is still more uncommon during childhood. Of 16 deaths attributable to the disease itself, and occurring among Dr. Hughes' 309 cases, 12 were of patients who were near, or had reached, or had passed the period of puberty; their ages varying from 15 years in the female, up to 25 in the male. Of other 16 fatal cases, recorded by Dr. Ogle, only 2 of the patients were under the age of 10, the eldest was 26. In the 80 non-fatal, all except 14 were younger than 16 years.

A very remarkable and long known fact in the history of chorea is its frequent association with organic disease of the heart, especially with such cardiac disease as often accompanies acute rheumatism of the joints. Neither acute rheumatism nor heart disease has yet come under our consideration; but it is necessary that I should, presently, by anticipation, mention some important points in the pathology of both. All that I need state now is, that in the course of an attack of acute rheumatism, the lining (as well as the investing) membrane of the heart is very liable to inflammation, by which its valves are permanently injured; and that such valvular injury almost always gives rise in the living patient to some unnatural sound during each beat of the heart—to what is called a cardiac *murmur*.

Another noticeable fact in the same history is that pregnant women are, more than other women, subject to chorea.

On former occasions, I have been in the habit of mentioning two conjectures which had occurred to me as to this singular coincidence of rheumatism and chorea. Rheumatism (as we shall see by-and-by) is especially a disease of fibrous structures, and it usually invades various fibrous parts at the same time. I thought it, therefore, not improbable that some morbid condition of the membranes of the spinal cord might have arisen simultaneously with the cardiac inflammation. Of this, however, we find no evidence in the teachings of morbid anatomy. Again, the cardiac injury might, I imagined, like some other structural diseases, be an eccentric exciting cause of the spasmodic disorder of the muscles: and this appears to have been Dr. Hughes's opinion. But a more probable theory was afterwards suggested by Dr. Todd and by Dr. Begbie. Acute rheumatism is a blood-disease; and it seemed likely that the unhealthy blood, circulating through the several organs, might be the common source and cause of the articular, the cardiac, and the spinal symptoms; and the bond of connection between them. This theory would explain also the occurrence, which Dr. Begbie had noticed and recorded, of chorea in some, and of acute rheumatism in others, of the same family. But a different, and, as I believe, a sounder solution of the difficult problem has more recently been propounded.

I told you, you may remember, that the late Dr. Kirkes was the first, in this country at least, to point out, as being one source of white softening of the brain, the closure of one of its nutrient arteries by a plug of lymph or fibrin, brought by the blood from some other part of the body, most often from the inflamed valves of the heart; and that this plugging of a blood-vessel has received the name of *embolism*. Now, Dr. Kirkes made use of the same principle in explanation of the occurrence of chorea—with this difference only, that the embolism is not of a considerable artery by a visible stopper of fibrin, but of minute microscopic arteries, or of capillaries, by fine microscopic particles of fibrin. And this view of the matter has been adopted and maintained by Dr. Hughlings Jackson, and ably discussed by no less competent persons than Dr. Russell, Dr. Broadbent, and Dr. Tuckwell of Oxford, on the affirmative side, and Dr. John W. Ogle and Dr. Barnes on the negative. I will endeavour to set the question before you as clearly and briefly as I may.

Dr. Kirkes began by analysing and settling the relationship of the morbid conditions in question; showing, first, that choreic symptoms ally themselves with endocardial, and not with pericardial disease; and, finally, that whenever chorea occurs in connection with rheumatism, the valves of the left chambers of the heart are inflamed; and therefore that the association is not between chorea and *rheumatism*, as was vaguely held, but really between chorea and *valvular disease of the heart*, so often accompanying, and caused by, the rheumatic malady.

Upon the inflamed valves are deposited what are commonly called *vegetations*, granules of fibrin sometimes exceedingly minute and numerous, arranged generally in rows by the action and pressure of the valves, soft, tender, easily broken away from their adhesions, and therefore readily washed off and carried along with the circulating stream of blood. In this way, it is believed, very minute particles may be injected into some of the microscopic arteries of the brain-mass (and of other organs), impair in a greater or less degree, and for a greater or less time, its condition and its functions, and so become one cause, at least, of that instability of tissue of which I spoke in the last lecture.

Now, this view is in perfect harmony with other facts of the disease. Ordinary chorea affects young persons principally; and, as I had observed and taught long ago, in proportion as the patient is young, the risk of the complication of heart disease with acute rheumatism is great.

A similar deposit upon the valves of the heart is incidental to certain cases of scarlet fever, and of pregnancy; and we find that chorea is not seldom associated with such cases.

Among the sixteen fatal cases enumerated by Dr. John W. Ogle, no less than 10 presented more or less of fibrinous deposit, or granulations, upon some portion of the heart's valves or lining membrane; and in 9 of the 10 the *mitral* valve was implicated.

Of 16 cases in Dr. Hughes' account, examined after *death during the existence* of chorea, the organs within the thorax were more or less diseased in 12; and in 11 of these 12, the sigmoid or the auriculo-ventricular valves of the heart were in a diseased state. In 5, if not in 6, of these 11 cases, the disease consisted in vegetations upon the edge of the *mitral* valve, and in one, similar vegetations were present upon the tricuspid valve.

Such vegetations were found in all of 5 fatal cases witnessed by Dr. Tuckwell.

Dr. Kirkes wrote thus: 'In all the fatal cases of rheumatic chorea examined after death by myself, the valves of the left side of the heart have presented unmistakeable proofs of recent inflammation, and evidence of like inflammation is furnished by the records of nearly every fatal case published, whenever the state of the valves of the heart is mentioned.'

I may observe that while the fibrinous deposits are found more frequently upon the mitral than upon any other valve, they are often on the auricular side only of its flap, and then may easily be overlooked.

Dr. Hughes ascertained that 'out of 104 cases of chorea, in which special enquiries were made respecting rheumatic and heart affections, there were only 15 in which the patients were both free from cardiac murmurs, and had not suffered from a previous attack of rheumatism.'

It is stated by Dr. Hillier, in his book on 'The Diseases of Children,' that in 37 cases of chorea observed by him, there were but 8 without any sign of cardiac disturbance.

'Of 19 cases observed by Dr. Tuckwell, there was evidence of disease of the heart in 15, doubtful evidence in 1, and absence of such evidence in 3.'

Among 24 choreic patients referred to in the London Hospital Reports, a systolic murmur at the apex of the heart was audible in 20; in five-sixths of the whole number.

I have no further statistics at hand bearing expressly upon this point, in respect of cases not fatal; but it is notorious that in a very large proportion of patients suffering chorea, some kind of cardiac murmur may be detected. It is this very symptom which first suggested the idea of some connection between chorea and acute rheumatism.

Now, cardiac murmurs sometimes arise simply from anæmia; the fault being in the quality of the blood, and not in the structure of the heart at all. And since the subjects of chorea are very commonly anæmic, it seems probable enough that the unnatural sound which so often accompanies the pulsation of their hearts may sometimes be attributable to their weak and bloodless condition. But in that case the murmur, which is systolic, will be most plainly audible over the *base* of the heart, as it is when the valves of the aorta are diseased; whereas you will find, I think—and this is a point which it will be well worth your while to note carefully whenever you have to deal with a choreic patient presenting a cardiac murmur—you will find, I say, most commonly, that the systolic murmur is more pronounced over the *apex* of the heart, and is also to be heard behind, under the left scapula; and if so, you may be almost certain that the diseased valve which gives rise to the murmur is the *mitral* valve; the valve that these little granulations especially affect. It is a regurgitant murmur, produced by the imperfect closure of the mitral orifice during the systole of the heart. Anæmic murmurs are rarely heard at the apex.

And observe here that the absence of murmur furnishes no conclusive evidence that there are no vegetations upon the valve in question: for they may be arranged upon its auricular surface in such a manner as not to interfere with the perfect closure of the auriculo-ventricular opening. So the frequency of the murmur does not fully represent the frequency of the cardiac complication. Occasionally, indeed, in the same case, and within the compass of a few days, the murmur will come, and go, and reappear, in consequence of changes that take place upon or near to the edges of the valve-flaps.

Dr. Tuckwell combats—triumphantly, as I think—a presumptive argument advanced by Vogel and others against the whole theory that chorea can be caused, remotely or immediately, by rheumatic carditis—namely, that whereas chorea is more common among females, rheumatism is more common among males. But at the early period of life during which chorea chiefly prevails, the fact is not so. The alleged inverse proportion does not hold. The adult man is more liable than the adult woman to the exciting causes of acute rheumatism, exposure to inclemencies and vicissitudes of weather, to cold, wet, and fatigue. But boys and girls are probably equally exempt from such exposure and risk. At the Children's Hospital, from the year 1852 to 1868, there were of in-patients having rheumatism 68 males and 78 females, of out-patients 158 males and 178 females. M. Roger reports that of 57 choreic patients who had rheumatism also, 24 were boys and 33 girls, all of them at or under the age of 14. So that there is harmony, and not dissonance, in the impugned theory, so far as sex bears upon it. 'The predominance of chorea in childhood and in the female sex may be accounted for by the predominance of rheumatic heart disease in the same sex and at the same time of life.'

The facts and reasonings which connect chorea with valvular disease on the left side of the heart are indisputably strong. I, for one, accept the conclusion that has been drawn from them,—namely, that the chorea is often—not always—the ultimate result of the injection of molecular particles of fibrin into some of the minutest arteries, or capillaries, of the nervous tissue.

I say emphatically *not always*, and the *ultimate* result.

To deliver my own present creed respecting this dimly seen subject—the first effect of the microscopic embolism upon the nervous tissue subjected to it is the gradual (sometimes, perhaps, the speedy) production of that condition which I spoke of in the last lecture as constituting *instability*: instability it must be presumed of the gray rather than of the fibrous cerebral matter. Dr. Russell has remarked upon the gradual way in which the actual disease developes itself. Of 100 cases noticed by him, four only were established suddenly. If the embolism be of a coarser kind, then actual destruction of tissue, white softening, will be likely to ensue, and then we have some form or degree of *paralysis*. But I concur with Dr. Hughlings Jackson in believing that a like instability may result from other causes than this scattered injection of molecules of fibrin; may even, for aught I know, be sometimes inherited. Dr. Johnson would doubtless suggest that a temporary instability of tissue may be caused by interruption of the circulation through a limited portion of the brain, from *spasm* of some of its minute arteries: spasm induced either by a purely emotional influence, such as that of sudden and extreme terror, or by certain unnatural conditions of the blood, such as we know to be present always in acute rheumatism, and sometimes in pregnancy; that molecular embolism, and spasm of minute arteries would necessarily have common to them both the effect of depriving a portion of the brain-mass of its full supply of nutritive blood. Whatever may have been its origin, whenever the unstable condition exists, chorea will be likely to happen.

The over-readiness to respond to ordinary impressions, the sensitiveness, the touchiness, if I may so speak, of the unstable yet unbroken tissue, explains how choreic movements may be excited by eccentric influences of various kinds; by fright or other mental emotion; by internal irritation, as that caused by worms; by derangement of the uterine functions, especially during the approach of puberty; by irregular or painful dentition; or in other possible ways. In those rarer and furious cases that end in death there has commonly been found white softening: the impairment has gone beyond the stage of instability, and reached that of breach of texture. Under this aspect of the matter the anomalous forms of chorea—those I mean which prove fatal, those which accompany pregnancy, those which are associated with epilepsy, or with palsy—find an easy and a reasonable explanation. In short, I conceive that there must be, generally, an unusual *predisposition* to chorea, before its exciting causes can avail to excite it; and that its most common predisposing cause is the minute injection of molecular fibrin into some of the smallest blood-vessels of that region of the brain which is supplied and nourished by the middle cerebral artery.

In some of the recorded cases of chorea during pregnancy, there had been chorea previously; marking the presence of the predisposition. I may add that while Dr. Broadbent is disposed to assign the morbid changes inducive of chorea to the sensori-motor ganglia themselves, Dr. Hughlings Jackson supposes that either the corpus striatum, or, with more probability, the neighbouring convolutions are to blame.

A very suggestive fact, bearing upon these speculations, is recorded by Dr. Aitken—namely, that in a case of general chorea which proved fatal and was inspected by himself, the *specific gravity* of the corpus striatum and optic thalamus of one side (the right) was 1028, while that of the other side was 1031.

Chorea is a complaint that is seldom attended with any bodily pain. I have in several instances, however, known it to be accompanied by pain of the head; and in some of them, with pain on that side *only* of the head which was opposite to the agitated limbs. I mention this as being of some practical importance; for I have found the disease to become sensibly less severe, and very soon to cease, upon drawing blood by leeches, or cupping, from the painful side of the head. In a greater number of cases, however, no such pain is experienced. Sometimes you will find that in all respects, excepting the nervousness, and the irregular movements, the patient is in the enjoyment of perfect health. But neither is this very common: generally there is something manifestly wrong in the state of the stomach and bowels, either before or during the complaint; a capricious appetite, costiveness, a tumid abdomen, offensive breath, a foul tongue: or irregular menstruation.

Probably anything which makes a forcible impression upon the nervous system may act as an exciting cause of chorea. Strong mental emotion, or a sudden mental shock, is very likely to bring it on in those who are predisposed to it. Of its ascertained or alleged exciting causes, *fright* is beyond all comparison the commonest. And, what is very curious, fright has been known to effect its cure. Dr. Hughes tells of a girl who having recovered from chorea, and suffered a relapse, was on her way to Guy's Hospital, for the purpose of seeking re-admission there. As she passed over London Bridge, she was terrified by seeing a person knocked down and run over. Before she reached the waiting room of the hospital, her malady was gone.

Doubts have, however, been expressed whether fright really has this effect so often as has been supposed—or at all. But I think those doubts unfounded. Certainly in some cases the disorder has followed instantly upon the cause of alarm. Thus Trousseau relates an example in which a girl of 16, who had never menstruated, on coming down stairs one night in the dark, was laid hold of by a man who was ascending the staircase. She was seized with chorea immediately. In another instance the disease followed at once upon the shock of a surgical operation. Dr. Bright quotes the case of a boy, aged nine, who had recovered from chorea, and was sleeping in the same bed with his father, and in whom the complaint was instantly renewed by the occurrence, in the father, of an attack of apoplexy. Here again the *return* of chorea discloses the predisposition to it.

I told you, in the last lecture, that epilepsy seems sometimes to be propagable by a kind of contagion, or rather of involuntary imitation. This strange feature is more or less discernible in many of the large family of nervous disorders occurring in sensitive constitutions. Accordingly, examples of it are not wanting in chorea. The fact has been noticed by M. Bricheteau in France. Dr. Chambers relates the case of a lad who had undergone, in St. Mary's Hospital, a surgical operation, and lay 'in a bed opposite to one occupied by a boy with St. Vitus' dance. He soon began to imitate the movements of his neighbour, and, though removed into another ward, got worse and worse, lost all control over his limbs,' and died at last of pericarditis and abscesses, due probably to pyæmia. Dr. John W. Ogle mentions two patients with chorea, who were at first in the same ward in St. George's Hospital. 'One was much worse than the other, and the severer case acted so injuriously upon the other, whose imitative powers appeared considerable, that they had to be placed in separate wards.' In these cases it is probable that a strong predisposition to the disease was present.

Chorea is observed to run in families; and the tendency to it is often plainly inherited. It is said to be very common in the families of Jews.

The disease has been observed to follow blows and falls on the head; but even in these cases the alarm may have had a greater share in producing it than the blow itself. It sometimes, I repeat, seems to depend upon irritation of the stomach or bowels, by improper diet, by accumulated fæces, or by worms; and it is found to be connected, in not a few cases, with difficult and painful menstruation. It frequently begins about the period of the second dentition: the late Dr. Gregory, of Edinburgh, was in the habit of relating instances of that kind. In one case, the old teeth were remaining, while the new ones were appearing by their sides. The old teeth were drawn, and the removal of the chorea was complete. This Dr. Marshall Hall would justly call eccentric chorea. But even in such cases the state of the gums cannot be regarded as the sole cause of the chorea: there must be the predisposition, as well as the accidental exciting cause; for the complaint is apt to recur under the agency of some new irritation, and then may cease under other treatment.

Chorea, in its ordinary form, may last from a week or two to some months. The disorder often terminates—at any rate much more often than epilepsy does—at the period of puberty; especially upon the first coming on of the menstrual discharge in the female.

I had occasion in the last lecture, to remark, that when a vast number of different drugs are recommended as specifics in any given disease, we may sometimes infer from that very circumstance that the disease is difficult of cure, and generally intractable under all plans of management. But there is another class of diseases which a variety of drugs are supposed capable of curing,—those, namely, which tend to terminate in health. I believe that many cases of chorea—most cases—would at length get well without any aid from physic: I believe also that many of the boasted specifics have been quite innocent of any share in the recovery of the patients to whom they were administered; at the same time I am quite certain that treatment may have a great influence over the disease.

It was Sydenham's practice first to bleed and purge his patients, and then to administer bitters, aromatics, and antispasmodics, with the view of strengthening the nerves. After his time the blood-letting and purgatives fell into disuse, until the publication of Dr. Hamilton's well-known work again brought the latter deservedly into favour.

The treatment of chorea embraces two definite objects. The first, and chief, is to give stability to the unduly moveable nervous centres. The second is to remove or avert whatever may be likely to excite or disturb them.

If the pathological speculations that I have laid before you be well founded—as I think they are—if some unsound condition of the brain-tissue, which we cannot more precisely define than as being an *unstable* condition, be a necessary factor in the production of the ordinary form of chorea, it is certain that this condition is capable of removal or repair under the healthy growth and completion of the bodily fabric. The customary escape from the disorder as childhood passes into womanhood or manhood supplies the proof. And if the instability be generated often by minute and scattered embolism of the microscopical bloodvessels, that mischief must admit of elimination by the lapse of time. That the recovery may be promoted by medicine I do not doubt: and recovery hastened may well be deemed a cure. It is rarely that there is any structural or inflammatory change to be combated. The instrument is not anywhere broken; but slackened, jangling, and out of tune: and (to pursue the metaphor) we often can help to restore its harmony by bracing it up again.

The ready recovery of many patients from chorea has been adduced as an argument against its production by minute embolisms. But this argument fails in weight when we remember that hemiplegia itself, caused by the plugging of a considerable artery, or even by the extravasation of a small clot of blood, is, sometimes, perfectly recovered from.

I can confidently recommend you to abstract blood locally in those cases in which there is a fixed pain in the head; but with this exception, blood-letting is neither useful, nor even (in my opinion) justifiable. There is oftener a deficiency than a redundance of red blood in the system.

I shall not attempt to distract your attention by discussing the various drugs that have been vaunted against chorea; but shall take the liberty of referring you to books (to Dr. Copland's 'Dictionary,' for example) for further information on that subject, and content myself with telling you what modes of treatment I have been in the habit of employing, with very satisfactory results.

It will be right, in all cases, to begin by clearing out the bowels with some active aperient; and you should persist in the regulated use of purgative medicines, if they continue to bring away much or foul fæcal matter. You are to be guided less by the amount of the doses than by the effects they produce; at any rate one full evacuation of the bowels should take place every day. But though purgatives are good auxiliaries, we cannot trust to them alone for the cure of the complaint.

One of the most effectual of the tonic remedies is the cold shower-bath, when it does not greatly shock or alarm the patient. To avoid this the water used may at first be tepid; by degrees it should be used cold. This remedy should be resorted to every morning, or every other morning, early, as soon as the patient gets out of bed. Of the best indications of the propriety of its continuance I spoke in the last lecture only; I need not tire you, therefore, by repeating the observations I then made.

With this external tonic it will be right to combine some internal one; and for the most part, the best for the purpose is some preparation of iron. The carbonate of iron is an exceedingly good form. It was the late Dr. Elliotson's *pet* remedy, who gave it in large doses, mixed with twice its weight of treacle, so as to form an electuary. But this method had its inconveniences. The treacle may be dispensed with if you employ the *Ferri carbonas saccharata*, or the *pilula Ferri carbonatis*, of the British Pharmacopœia. The dose of the carbonate may be increased from 10 grains to a drachm or more three or four times a day: but when these large doses make no apparent impression on the disease, you had better change the form of the medicine. Give two or three grains of the sulphate of iron for a dose, or half a scruple of the citrate, or an ounce and half of Griffith's mixture (*mistura ferri composita*), or twenty or thirty minims of the *tinctura ferri sesquichloridi.* Dr. Bright says he has found the sulphate of zinc answer when the carbonate of iron had failed, and the iron succeed when the zinc had done no good. One most severe case, about which I was consulted, and which had resisted other remedies, got well under the use of the sulphate of zinc; the dose of which was gradually increased to ten grains, given three times a day. Whenever the medicine was pushed beyond this point it became emetic. This seems to have been the favourite remedy in Guy's Hospital, where the dose has sometimes been carried, Dr. Hughes informs us, as high as half a drachm, two scruples, and even in one instance forty-two grains, thrice daily. It cured forty-five out of sixty-three cases; five in every seven. Certainly the disease is often very obedient to arsenic; but, for plain reasons, it is better to effect a cure, when we can, by less hazardous substances. The gravest case I ever had to treat occurred in one of my hospital patients. I tried the carbonate of iron in vain. The shower-bath so terrified and agitated the girl that I could not persist with it. I then gave her arsenic, under which she mended at first, but it ultimately proved injurious; her bowels were greatly irritated by it, she became paralytic in her lower extremities, and sank into a typhoid state; and I really was afraid that I should lose her. But she recovered from this condition, which I could not but ascribe to the arsenic; and as soon as I dared venture, I began to give her the muriated tincture of iron, twenty drops at a time, every six hours. Under this treatment she steadily and rapidly improved, and was soon quite well.

Dr. Begbie, in an experience of nearly thirty years, had never known arsenic to fail. He gave five drops of the *liquor arsenicalis* twice a day, an hour after meals, adding one drop every third day, until the specific effects of the mineral upon the system began to be observable; then he withdrew it for a while. 'The earliest manifestation of these effects are itching and swelling of the eyelids, redness of the conjunctiva, nausea, and uneasiness at the pit of the stomach, and particularly a peculiar white silvery appearance of the tongue, seldom accompanied with tenderness.'

The oil of turpentine also is certainly a valuable medicine in this disease; whether there be worms at the bottom of it or not. When the bowels are torpid, and the girl is of that age when menstruation may be conjectured to be at hand, its arrival seems sometimes to be accelerated, and great relief to be produced, by the turpentine. The best way of prescribing it in such cases is in combination with an equal quantity of castor oil; two drachms or half an ounce of the *mixture* may be given every morning, or every other morning, according to its effect upon the bowels; and when they are very sluggish, or the stools are unnatural, it will often be serviceable to give a couple of grains of calomel also, twice or thrice a week, at bed-time.

The singular efficacy of the bromide of potassium in cases of ordinary epilepsy would naturally suggest a trial of that drug in the ordinary forms of chorea. I have had no opportunity of putting it to this test. But Dr. Radcliffe has given it, with a strong prejudice in its favour, in several cases, and tried it fully, with unsatisfactory results.

Very rarely indeed—as I have more than once said already—has any *successful* drug-medication been dictated by *a priori* considerations—but the thoughtful physician whose name I have just mentioned seems to have achieved an exception to this rule. The suggestions of his reason have been borne out by the results of his experience. 'Remembering,' he says, 'that fatty matter is an essential ingredient in nerve-tissue'—also 'that phosphorus is present in large quantity in the great nervous centres—and in much larger proportion in healthy adults than in infants or in idiots,'—and inferring from that fact that it might furnish food for a weak nervous system—he has for several years been prescribing cod's liver oil and phosphorus in cases of ordinary chorea, with unmistakeable benefit. In upwards of thirty cases thus successfully treated, the average duration of the treatment was (he says) under three weeks.

The phosphorus may be melted, in a closed vessel, in the prepared suet of the Pharmacopœia; and the mass be made into pills, which should be coated with gelatine, and contain, each of them, three grains of suet, and one-thirtieth of a grain of phosphorus. Or, from five to eight grains of hypophosphite of soda, dissolved in water, may be given instead, three times a day.

It is scarcely necessary for me to say that due attention must be paid to the diet. This ought to be plain and simple, but at the same time nourishing, and even generous. Exercise, short of that which produces fatigue, in the open air, in fine and dry weather, will also conduce much to the patient's recovery. And all kinds of immoderate *emotion* should be guarded against: for the contest often seems to lie between the emotional and the voluntary impulses to action. The stillness of the muscles during sleep is in accordance with this belief.

There is an affection (it scarcely deserves to be spoken of as a disease) which is sometimes called chorea, of a chronic nature, and resembling the disorder I have just been speaking of, inasmuch as it commonly is met with in nervous persons, and consists in the irregular, unmeaning, and involuntary contraction of certain muscles, especially in the limbs, neck, or face: but differing from it in this, that always the same muscles are affected, and in the same way; that it lasts long, almost always for life, and implies no accompanying derangement of the general health. In its slighter form the irregular movements are rather *awkward tricks* than spasms: little shakes of the head, or rapid and repeated elevations of the eyebrows, or corrugations of the nose, or sniffings and snortings through the nostrils, or shrugs of the shoulders—movements of which the person seems scarcely conscious. At other times, however, the motions are more extensive; a limb starts out, or the head is turned awry; and the individual who performs these manœuvres is quite aware that he does so, and vexed and annoyed at the ridiculous figure he makes, but he cannot help performing them; or if he can prevent it, the necessary effort is worse than the disease. One young man who was subject to this infirmity told a friend that he could stop the movement by a strong exertion of his will: but *that exertion* was extremely painful, and was followed by languor and much discomfort. A patient of my own told me recently a somewhat similar history, which describes a link between these tricks and true chorea. For several months she had been plagued by involuntary lateral jerkings of her head. Upon their first occurrence she was suddenly freed from great mental depression, under which she had long been labouring. If, by a determined effort, she controlled her head, the jerking movement was immediately transferred, generally to her left arm, but always to some part of the left side of her body. In many instances the continuance of the affection is doubtless the result of a long-established *habit*. It occurs more frequently in men than in women. I had for a long time, as an out-patient at the hospital, a girl about seventeen years old, in all other respects the picture of health, but who was annoyed by an involuntary shake of the head, which took place two or three times in a minute. She received no benefit from medicine. A lad in my own service was affected in a similar manner. He seemed to be giving me, and my friends, from time to time, a familiar nod: and I was obliged to part with him. Others are subject to twitchings of the face. I am acquainted with one gentleman who is perpetually wrinkling his nose; and he has assured me that he was subject, when young, to an involuntary shake of the head, like the three persons just mentioned; but a blister having once for some reason been applied to his throat, the shaking of the head was thereby rendered painful and difficult, and the movement of the head ceased: but (as he expressed it) it broke out in his nose, where it triumphs to this day. This *chronic chorea*, as it has been called, I merely mention to prevent your confounding together two affections which, though they have received the same name, and are in some respects analogous, yet differ in still more points, and those points of more importance. I believe that medicine has no power over any of these tricks. They are distressing and unsightly, but in no way dangerous. If they are to be gotten rid of at all, it must be by rigid watching and determination on the part of the patient to break the ugly habit.

The word chorea, which you know signifies a *dance*—and the trivial term, St. Vitus's *dance*—are not very appropriate to *either* of the modifications of the nervous affection which I have been noticing. In fact, that term was originally applied, and much more suitably, to another set of symptoms of a most singular kind, concerning the real occurrence of which we might well be sceptical, if we had not authentic narratives of many instances of such disorder from different persons of credit, as well in this country as in others. What has happened many times before may happen again; and you ought not to be in ignorance of the histories to which I allude. They relate to an affection characterised by movements that cannot be called spasmodic, but are rather owing to an irresistible propensity to muscular action, increased sometimes to a sort of mania by the force of imitation, or by the sound of music. It is the *volition* that, in these cases, is morbid and perverse. You might fancy the patient to be possessed and coerced by an evil spirit, like the δαιμονιζομενοι of the Gospel history.

Some of the subjects of these extraordinary affections, impelled by a strange and unintelligible necessity, execute measured and regular movements with surprising energy, rapidity, and perseverance. When music is performed in their hearing, the movements become an actual dance; and where crowds are collected together, the dancing mania is apt to spread from person to person by a sort of imitative infection; realising the fable of Orpheus, and giving origin (it may be presumed) to those romantic legends met with in the literature of most ages and countries, of universal, involuntary, and unceasing saltation, at the sound of a magic pipe. To these feats the term *chorea* is apposite enough. Indeed, I have seen it somewhere suggested that the phrase *chorea Sancti Viti* is but a vulgar corruption of *chorea Sancti inviti*; and took its rise in the misfortune of some holy person who chanced to be afflicted with one of these unwilling but invincible impulses to caper. The common explanation makes this holy person to have been a certain German Saint Weit, to whom a chapel is said (I know not with how much truth) to be dedicated at Dresselhausen, in the district of Ulm, in Suabia.

Sometimes, instead of dancing on their feet, these patients drum and beat with their hands, either upon their own knees, or upon the objects near them. This variety has received the bombastic title of 'malleation.' Sometimes they circumvolve with great rapidity; or they turn their heads repeatedly from side to side with great velocity: this is 'rotation.' When they are irresistibly impelled to move in a given direction, the term 'propulsion' is employed. The very invention of these names attests the reality of the disorder.

You will find one of these singular cases related by Mr. Kinder Wood in the seventh volume of the 'Medico-Chirurgical Transactions.'

The patient was a young married woman. After having suffered severe pain in one side of her face, she began to be troubled with involuntary movements. They commenced in the eyelids, which were opened and shut with excessive rapidity. Then the muscles of the extremities became affected. The palms of the hands were beat rapidly upon the thighs, and the feet upon the floor. The motions soon extended to the trunk and pelvis. The patient was suddenly half raised from her chair, and instantly reseated. This was repeated as quickly as one action could possibly succeed another. Sometimes she had a propensity to leap upwards, and strike the ceiling with the palm of her hand; or to touch little spots or holes in the furniture of the room. Or she would dance on one leg, holding the other in her hand. These attacks were accompanied by headache, sickness, and vomiting. At last she took to making steps about the room, regulated by an air, or by a series of strokes on the furniture as she passed, her lips moving as if words were articulated, but no sound escaping them. A person thinking he recognised the tune which she beat on the furniture, began to sing it; and she danced directly up to him, and continued dancing till he was out of breath. A drum and a fife were now procured, and the same air played upon them. She immediately danced up to the drum, and as close to it as possible, till she missed the step, when the motions instantly ceased: and this was found always to be the case. The motions stopped also when the measure was changed; or was increased in rapidity beyond her power to keep pace with it. A continued roll on the drum had likewise the effect of putting an end to her movements. This being discovered, their approach was watched; and by always rolling the drum as soon as they threatened to begin, the chain of association which seemed to regulate the disease was at length broken. The bowels were in an unnatural state during the complaint; and on the evening of the day on which it ceased the menstrual discharge re-appeared. One might conceive that the conduct here described was an indication of folly or of insanity; but Mr. Wood declares that the patient's spirits were good, and her perception and judgment accurate and just; that during the absence of the paroxysms she went about her household affairs as usual; and that she had a correct knowledge of her situation, and of the advantage she derived from the drum, with an anxious desire to continue its use. She stated 'that there always was a tune dwelling upon her mind, which at times becoming more pressing, irresistibly compelled her to commence the involuntary motions.'

In a lady, whom Dr. Abercrombie saw, the following symptoms, among others, occurred:—After she had been ill with various nervous affections for two years, she began to suffer convulsive action of the muscles of the back, and involuntary twitches of the legs and arms, producing a variety of movements of the whole body very difficult to describe. These were much increased by touching her, especially on any part of her back. This is a symptom quite in conformity with Dr. Hall's doctrine of eccentric irritation. At one time there was difficulty of deglutition, so that attempts to swallow produced spasms, resembling those of tetanus. At other times, after lying for a long while quiet, she would in an instant throw her whole body into a kind of convulsive spring, by which she was jerked entirely out of bed: and in the same manner, while sitting or lying on the floor, she would fling herself into bed, or would leap, as a fish might do, upon the top of a wardrobe fully five feet high. These are feats that surpass the powers of a person in health: and I say we should hesitate to believe them if they were not related by a physician of such sober judgment and unquestionable veracity as Dr. Abercrombie. He tells us that during the whole of these symptoms her mind continued entire: and the only account she could give of her extravagances was, a secret impulse which she could not resist.

But, after a time, motions still more wonderful commenced, affecting the muscles of the upper part of the back and neck, and producing a constant semi-rotatory motion of the head.

This sometimes continued without interruption night and day for several weeks together: and if the head or neck were touched, the motion was increased to a most extraordinary degree of rapidity. These paroxysms were relieved by nothing but cupping on the temples to the amount of ten or twelve ounces, when the affection suddenly ceased, with a general convulsive start of the whole body. She was then immediately well, got up, and was able to walk about in good health for several weeks, when the same symptoms returned, and required a repetition of the same treatment. All this went on, at intervals, for four years; the menstruation during that time being irregular and scanty, and the bowels torpid. She was pale and bloodless from the frequent bleedings, but not reduced in flesh. At last, in the spring of 1829, she had a severe paroxysm of the rotatory motion of the head; and it was then determined to allow the attack to take its course, and to direct the treatment entirely to the menstruation. Sulphate of iron, and Barbadoes aloes, were prescribed. She went on for three weeks, the convulsive motion of the head continuing without intermission night and day. At length, in the middle of the night, the paroxysm ceased in an instant, with the same kind of convulsive start of the whole body with which it used to cease after cupping. At the same instant menstruation took place in a more full and healthy manner than it had done for many years. From that time she remained well; at least up to the period when Dr. Abercrombie wrote the account.

The alternating rotatory motion of the head is by no means an uncommon feature of these singular cases. It occurred in a patient of Dr. Conolly's; in whom the menstruation was irregular, and about to cease altogether. It came on in paroxysms which were repeated many times a day, and it was attended with inordinate loquacity. The head was turned from side to side about eight times in a second, and each paroxysm lasted three or four minutes. The patient got well after being cupped and leeched, and thoroughly purged. I have seen precisely the same thing in a hospital patient. Dr. Crawford met with an instance of involuntary rotation of the head, without pain, but attended with intolerance of light. And there is a striking example of it described in the twenty-third volume of the 'Edinburgh Medical and Surgical Journal,' by Mr. Hunter, of Glasgow, who speaks of it under the name of 'rotatio or chorea.' The motions are said to have been furious and alarming: they were executed with such extreme rapidity, that it was difficult even for the eye to follow them. She appeared, Mr. Hunter says, absolutely to be looking backwards and forwards, and in every direction, at the same moment. This woman had sometimes fifty paroxysms of this kind in a day: they greatly exhausted her; but she was perfectly rational in the intervals. A modification of the same kind of affection took place in a most extraordinary case recorded by Dr. Watt, of Glasgow, in the fifth volume of the 'Medico-Chirurgical Transactions.' His patient was a girl ten years old. First she had headache, accompanied by vomiting, and increased by the slightest deviation of the body from the erect posture, either backwards, or forwards, or to one side. These symptoms lasted about a month; and during that time she lost the power of speech and of walking. At the end of that period she was seized with a propensity to twirl round on her feet, like a top, with great velocity, always in one direction; and was pleased when those about her assisted in increasing the rapidity of her movements. After continuing nearly a month, these motions ceased, the headache returned, and she became unable to move her neck, or support her head. Soon after she was visited with a new kind of motion: she would lay herself across the bed, and turning over like a roller, move rapidly from one end of it to the other. At first the fits of this kind lasted two hours; but they gradually extended to six or seven hours every day. On being carried into the garden she rolled rapidly from one end of a gravel walk to the other; and even when laid in the shallow part of a river, though apparently on the point of being drowned, she began to turn round as usual. The rotations were about sixty in a minute. She made little or no use of her arms in revolving. In about another month or six weeks an entirely new set of movements began. She lay upon her back, and, by drawing her head and heels together, bent herself like a bow, and then allowing her head and heels to separate, her buttocks fell with considerable force upon the bed. She repeated these movements ten or twelve times in a minute, first for six hours daily, and at length for fourteen. After another space of about five weeks had elapsed, the most singular freak of all ensued; she became possessed with a propensity to stand upon her head with her feet perpendicularly upwards. As soon as the feet were elevated in this manner, all muscular exertion seemed to be withheld, and the body fell down as if dead; her knees striking the bed first. This was no sooner done than she instantly mounted up as before; and continued to do so from twelve to fifteen times in a minute, for fifteen hours a day. After a variety of fruitless treatment, a spontaneous diarrhœa came on, and she recovered.

The spinning motions observed during a part of this case have been observed in other instances.

In Magendie's 'Journal de Physiologie,' the two following singular forms of disease are referred to. A man, after some other symptoms of cerebral disorder, was seized with an irresistible inclination to move forwards, stopping only when exhausted. He would sally forth into the streets, and continue walking straight forward until he dropped down from fatigue, and was obliged to be brought home in some conveyance. This man at length died, and several tubercles were found in the anterior hemispheres of his brain. Dr. Laurent, of Versailles, exhibited to the Academy of Medicine a young girl, labouring under the exactly opposite necessity. In the attacks of a nervous disease she was irresistibly propelled backwards, and with some rapidity: being unable to avoid obstacles or hollows, she received many falls and bruises in her course.

I say that histories such as I have been giving you some samples of, and those mostly in an abridged form, would sound very like romances, if they were met with in the old authors alone, or if they were not attested by unimpeachable authority. They resemble chorea in this respect, that they are examples of muscular actions performed by persons in possession of consciousness, and performed in spite of themselves. But in most other respects they differ from what we now-a-days mean when we speak of chorea. Perhaps they may rank among *hysterical* vagaries. It is remarkable that the majority of them occur in young women, in whom the menstrual function is suspended or irregularly performed. Some persons may consider them as varieties of insanity. The patients certainly did not *feign* to be ill, for the feats of strength and agility which many of them enacted were much beyond their natural power and endurance. The truth seems to be, that there are innumerable modifications of the nervous functions, and that some of them are more common and more capable of being arranged into groups than others; but that they all offer points of resemblance, like (as I observed before) the different members of a large family, in which the individuals have the same general cast of features, and yet preserve each his particular identity.

I advert to these odd forms of disease with the view of directing your attention to such of them as may come in your way. We are yet terribly in the dark about morbid affections of the nerves, both organic and functional. Hereafter some medical Newton will arise, and reduce all these apparently complicated phenomena under one simpler law. At present all that we can do is to collect and, as far as we may, to arrange facts, in the hope that at length some better light will be shed upon the subject. And it must be observed that some of the modern researches into physiology do throw a little glimmering of illumination into these dark corners of pathology.

In certain of M. Magendie's experiments on animals the following curious facts were ascertained:—When a vertical section of the cerebellum of a rabbit was made, leaving one-fourth of the whole adhering to the crus of the right side, and three-fourths to that of the left, the animal rolled over and over incessantly, turning itself towards the injured side. The same phenomenon occurred upon the division of the crus cerebelli. The animal lived for eight days, and continued during the whole of that time to revolve upon its long axis, unless stopped by coming in contact with some obstacle. How like is this to the symptoms exhibited at one period in the girl whose case is related by Dr. Watt! Nor is Dr. Watt's case a singular one; M. Serres has described another much resembling it. A shoemaker, sixty-eight years old, of intemperate habits, after one of his debauches exhibited a kind of drunkenness which surprised his friends. Instead of seeing objects turn round him, as a drunken person is apt to do, he thought he was himself turning, and soon began to revolve; and this lasted till he died; and when his head was examined, extensive mischief was found in one of the peduncles of his cerebellum.

Again, M. Magendie noticed that when the upper part of the cerebrum is gently removed in birds and mammalia, they become blind; but no affection of the locomotive powers is produced. No further result is occasioned by the removal of a portion of the gray matter of the corpora striata: but when the striated part is cut away, the animal immediately darts forward with rapidity, and continues to advance as if impelled by some irresistible force, until stopped by an obstacle; and even then it retains the attitude of one advancing. The experiment was tried with the same result upon various species of animals—dogs, cats, hedgehogs, rabbits, Guinea-pigs, and squirrels. It seems that there are horses that cannot *back*; although they make good progress enough in a straightforward direction. Now Magendie says that he has opened the heads of such horses; and has always found, in the lateral ventricles of their brains, a collection of water, which must have compressed and even disorganised the corpora striata. It has been further ascertained, by the same experimenter and by others, that certain injuries of the cerebellum cause animals to move backwards contrarily to their will. If the tail of the animal so mutilated be pinched, he still persists in his retrograde course. Injuries of the medulla oblongata had the same effect. Pigeons into which he forced a pin through that part, constantly receded for more than a month, and even *flew* backwards. A section of the medulla oblongata, where it approaches the anterior pyramid, gives rise to a movement in a circle, like that of a horse in a mill; the animal, in its walk or its flight, bearing round continually to the injured side. Surely we have, in these facts, supplied by experiments on living animals, and by observation of the phenomena of disease in the living human body, some of the *materials* for a more exact knowledge, both of the physiology and of the pathology of the nervous system, than we have yet reached. M. Magendie supposes that different portions of the encephalon are endowed with energies which tend to cause motion in various directions; that in the healthy state these balance each other, and that a preponderating impulse can be given to any one of these forces by the will; but that when the equilibrium is destroyed by disease, the will is not sufficient to counteract the tendencies which are then brought into play. Mr. Mayo offers a different explanation of the phenomena. He supposes that the injuries inflicted on the nervous matter produce a sensation analogous to vertigo; and that the animal conceives itself either to be hurried forward, and makes an exertion to repel the imaginary force; or to be moving backward, or turning round in one direction, and endeavours to correct this by moving the corresponding muscles. Whatever may be the true explanation, the facts themselves are abundantly curious and interesting, and I recommend them to your attention.

Some of the affections that I have been describing, fall, perhaps, under the category of those to which the appellation of the *leaping ague* has been given in some parts of Scotland. There is a class also of convulsive spasmodic affections which resemble epilepsy on the one hand, and chorea on the other, or rather form a link of alliance between the two, and which are especially remarkable for this, that they are capable of being propagated by that kind of imitative contagion of which I have several times spoken. This point might be well illustrated by the history of various sects of religious enthusiasts. One or two of those enthusiasts have apparently at first worked themselves up into a state approaching to epilepsy, accompanied even by insensibility sometimes; and then this state has been communicated by sympathy to the more susceptible of their auditors. I must not, however, go into any further details on this subject; and perhaps I have prosecuted it too far already. Those among you who are inclined to pursue it further may find some curious accounts of an epidemic which occurred in Lanarkshire, in Sir John Sinclair's 'Statistical Account of Scotland,' under the head of the 'Conversions of Cambuslang;' and in one of the early volumes of the 'Edinburgh Medical and Surgical Journal.' Dr. Robertson has described, in an inaugural dissertation 'De Choreâ Sancti Viti,' a similar epidemic, which occurred in the states of Tenessee and Kentucky, in the western districts of America. This is also referred to in the same volume of the journal. Among other things Dr. Robertson says, that while extravagant sounds, and actions, and gesticulations, were in the first instance *wilful*, the actors 'at length, to their own astonishment, and the diversion of many of the spectators, continued to act from *necessity* the curious character which they had commenced from *choice.*' I will only remark further of such forms of nervous disease, that as they spring often from moral causes, so they admit, in a great degree, of moral remedies. The pranks played by the Scotch enthusiasts were brought to an end by threatening to duck everyone who should thereafter be attacked; and, I believe, a few of them *were* horse-ponded, by way of example. With respect to the solitary instances of perverted locomotion, our business must be to correct whatever is wrong in the state of the bowels; in women, to amend the disordered uterine functions; to invigorate and confirm the system generally; and, in addition to the measures proper to effect these objects, I suspect that the cold sousing would in many cases be found of most material service.

Another definite form of disease has, within a comparatively recent period, been singled out from the crowd of symptoms engendered by disorder of the nervous system, and been stamped with the hybrid title of *Locomotor Ataxy.* Even three different languages have been put in requisition in the naming of the disease, for to these two words is often prefixed a third—the word *Progressive.*

This disease was clearly, though very slightly sketched, and its pathology foreshadowed, by the late Dr. Todd. His outline of its form was filled into a complete picture by M. Duchenne of Boulogne; while its true pathology has been certified by microscopic research under the practised and accurate eyes, and with the peculiar method, of Dr. Lockhart Clarke.

I will first describe the disease by its symptoms, pointing out, as I go along, how it resembles on the one hand, and how on the other it differs from, diseases which we have already had before us.

A man in whom this form of disease has fully declared itself, finds much difficulty in walking, especially when he first starts; not because he cannot move his limbs, but because he cannot *rightly* move and manage them. He is unable to balance himself except in the awkward manner in which an unpractised skater, or a boy who tries to walk on the top of a narrow fence, endeavours to keep his equilibrium, by swaying his body this way and that, and throwing hither and thither his outstretched limbs. When fairly started, he staggers or straddles on with short and hurried steps, in which the heels come first and forcibly to the ground, steadying himself by the help of a stick, or seeking for support by laying his hands on the furniture of the room, or on other objects near him. Before he can attempt to turn round in his march he is obliged to stop short, and wait. He is glad to avail himself of a friendly arm, and then makes better progress. In these endeavours his air and gait resemble those of a drunken person.

One very remarkable symptom is that the patient is still more unable to walk—cannot walk at all—*in the dark.* We all find that more or less puzzling: but he cannot move onwards a step unless he can see his feet. More than this—if his feet be placed parallel and close to each other, he cannot even *stand* in the dark, or with his eyes closed, but sinks down at once. This is not the effect of mere blindness (although he often is partially blind), for a blind man, or a healthy man with shut eyes, is able both to stand and to walk. The difficulty has a different source. He has lost the power of controlling into harmony the various muscles, or groups of muscles, of which the combined action is requisite for steady progression. For effecting this harmony it is indispensable that the several muscles concerned should contract and relax exactly at the proper time, and to the due extent. In almost every instance the failure shows itself first and principally in the patient's legs, which feel to him unnaturally heavy; sometimes he suddenly discovers, to his own surprise, that he is unable to run. You suspect, when he comes to consult you, that he has incipient paraplegia, and your suspicion is strengthened when you are told that he has some infirmity of the urinary organs. You see that he moves and walks with difficulty, and you hear that he has not perfect control at all times over his bladder. In fact these cases were usually mistaken heretofore for cases of paraplegia. But there is no muscular palsy, neither wasting nor want of power in the muscles. When the patient is sitting, or lying, you may find it difficult, perhaps impossible, to bend, or to straighten, one of his legs against his opposing will. It is their joint harmonious action that he cannot command. He may be capable of bearing on his shoulders a heavy load. Supported by the arm of another, he may be able in a certain fashion to walk, but his gait, when he can thus walk at all, is peculiar. A blind man moves slowly and cautiously: a subject of this disorder soon hurries his pace, and makes short precipitate steps. The alternate contractions and relaxations of his limbs are sudden, and consist of spasmodic jerks, with a characteristic descent of the heel, or backward kick. Dr. Lockhart Clarke observes that not only the due co-ordination of the muscles is in fault, but also the degree or extent of their contraction. In advanced stages of the disease, the patient's legs, in his attempts to walk when he is held up by the arms, are apt to get crossed and entangled together. There is numbness also of the feet and legs, and odd sensations which confuse and perplex his ideas, and he expresses the perverted sensibility by various similitudes. He seems to himself to be shod with cushions, to be treading on india-rubber, or as if the ground were sinking from under his feet. Some patients say they are walking on their ankles; or that they have no hold of the ground. By degrees the affection creeps up to the upper limbs; the arms, hands, and fingers partake in the ataxy, and in the numbness, which last is especially noticeable on the ulnar side of the forearm. The patient can no longer pick up a pin; fumbles at his buttons; is unable to tye his neckcloth; misses his aim. 'If (says Dr. Lockhart Clarke) he tries to touch his nose with his finger, his hand very likely is involuntarily carried to his cheek, or to the side of his head.' These *look like* choreic phenomena. Whatever sensibility to touch remains in the numb parts is slowly, and only after a well-marked interval, perceived by the mind. It is curious too that the perception of varying degrees of temperature is much less diminished than the ordinary sense of touch.

I have mentioned incidentally the partial blindness to which these patients are subject. Sometimes they squint, see double, or are more or less amaurotic. The third and sixth cerebral nerves are apt to be affected. The optic disc shows white atrophy. Duchenne speaks of these affections of the vision as constituting the earliest of the symptoms.

Another early symptom is the occurrence, from time to time, and sometimes coming in crops with long intervals between them, of sharp neuralgic pains; rapid, transient stings and twinges, here and there, varying in their situation, and visiting the patient with electric suddenness.

The march of this formidable disorder is mostly slow. Sometimes, having reached a certain point, it stops, remains stationary, even some slight improvement may present itself. More commonly, after such a pause, it resumes its progress; justifying to the physician's experience the sad epithet *progressive*, but not therefore warranting its desponding and depressing use in speaking of his disease to the patient. Indeed the epithet is not universally exact. The malady may last twenty years, or more. It usually ends by gradually consigning the patient to his bed, where he gets weaker and weaker, bed sores form, and he sinks exhausted.

You cannot, I say, when on your guard, confound this disease with paraplegia. The gait, when the patient can walk at all, is distinctive. The patient in paraplegia trails his legs; the toe, when the foot is lifted, is the last to leave the ground, and the first to flap down again. Whereas in ataxy the leg is lifted briskly, and the heel is jammed down in its descent. The muscles waste in the one case and not in the other. The incontinence of urine in paraplegia is the result of paralysis; in ataxy it probably has something to do with the anæsthesia, which prevents the natural sensation of a desire to empty the bladder, till some of the urine is felt in the urethra, whence it escapes before the patient can help it.

Neither again can the disease be mistaken for chorea, although there are points of resemblance between them, and its definition as made by Dr. Lockhart Clarke would fit either disorder. Locomotor ataxy 'consists (he says) of a peculiar unsteadiness in the performance of certain voluntary motions, arising from the loss, to a greater or less extent, of voluntary influence to control and combine, or co-ordinate, the action of the muscles necessary for the steady performance of these movements.' But the distinctions are broad and strong. Chorea is a disease of youth—affects females oftener than males—is mostly curable, or ends in early recovery—is marked by constant restlessness: whereas locomotor ataxy occurs much most often in males—at the age between 20 and 40—is not marked by restless movements—is of long duration, and probably incurable.

Dr. Todd was the first, so far as I know, who made known the existence of this disorder as a distinct and separate malady; and I mention this particularly as it sheds a ray of lustre upon this College, in which he was so distinguished a Professor. In the year 1845, in the third volume of the 'Cyclopedia of Anatomy and Physiology,' he thus writes:—

'Two kinds of paralysis of motion may be noticed in the lower extremities;—the one consisting simply in the impairment or loss of voluntary motion; the other distinguished by a diminution or total loss of the power of co-ordinating movements. In the latter form, considerable voluntary power remains, the patient finds great difficulty in walking, and his gait is so tottering and uncertain that his centre of gravity is easily displaced. The cases are generally of the most chronic kind, and many of them go on from day to day without any increase of the disease, or improvement of their condition. In two examples of this variety of paralysis I ventured to predict disease of the posterior columns, the diagnosis being founded upon the views of the functions of the columns which I advocate; and this was found to exist on a *post-mortem* inspection: and in looking through the accounts of recorded cases, in which the posterior columns were the seat of lesion, all seem to have commenced by evincing more or less disturbance of the locomotive powers.'

Duchenne's first memoir was made public in 1857. In that and in subsequent papers he fully depicted the exact character of the disease, and established his right to be considered the main authority on the subject.

The morbid anatomy of the disorder tends to confirm those doctrines of modern physiology referred to by Dr. Todd, respecting the functions of certain portions of the spinal cord.

'The posterior columns and the posterior nerve roots are the parts of the cord that are chiefly altered in structure. The alteration is peculiar, and consists of atrophy and disintegration of the nerve fibres to a greater or less extent, with hypertrophy of the connective tissue, which gives to the columns a grayish and more transparent aspect; and in this tissue are imbedded a multitude of corpora amylacea. Many of the blood-vessels that traverse the columns are loaded or surrounded, to a variable depth, by oil globules of different sizes.'

Dr. Lockhart Clarke adds that for the production of the disease it seems to be requisite that the morbid changes should extend for a certain length—from one to two inches—of the cord: that the posterior nerve roots both within and without the cord are frequently affected by the same kind of degeneration: and that not unfrequently the extremities of the posterior cornua, and even deeper parts of the gray substance, are more or less damaged by areas of disintegration.

It is in the lower portion of the cord that these things are the most common and the most pronounced.

The treatment of this disorder must in the main be that which is indicated in all disorders that are incurable; and it may be summed up in the brief precept—to husband and sustain the general strength. By rest, namely, by protection against avoidable injurious influences, by suitable diet, and by such medication as these ends imply and suggest. If, in locomotor ataxy there is ever ground for the administration of specific drugs, it must be (and this observation is widely applicable) in those cases in which we are able to trace or to suspect the previous operation of the poison of syphilis, and therefore to indulge the hope that it may have been causative of the disease before us. In such cases it will be right to give our patient the chance of benefit from the iodide of potassium, or from mercury, or best of all perhaps, from some combination of these drugs. If in a mixture consisting of a fluid ounce of the tincture and a fluid ounce of the syrup of orange peel, you dissolve one grain of the bichloride of mercury and one drachm of the iodide of potassium, you will have a pleasant and effective combination of this kind, of which one fluid drachm may be given in an ounce and half of water, two or three times a day.

LECTURE XXXIII.

Paralysis Agitans. Mercurial Tremor. Wasting Palsy. Hysteria: Two Forms of Hysteric Paroxysm; Diagnosis from Epilepsy; Class of Persons most liable to Hysteria; Diseases apt to be simulated by Hysteria; Treatment: Prevention.

In the last lecture I spoke of chorea, and of some singular forms of disorder that have sometimes been included under the same appellation. I gave also a summary account of locomotor ataxy. I shall begin the present with a few observations concerning a disease very closely allied to some of those which we were then considering, and yet distinct enough to deserve and require a separate notice. I refer to what has been badly called the *shaking palsy—paralysis agitans*: badly, because paralysis agitans is another example of a hybrid name, and because there is in truth no paralysis at all. But the term is familiar to professional ears. Allusions to this form of disease are to be found in many of the older systematic writers on physic; but it never was much attended to in this country until Mr. Parkinson published an essay upon it in the year 1817; and a very interesting little pamphlet it is. He defines the disease thus:—'Involuntary tremulous motion, with lessened muscular power, in parts not in action, and even when supported: with a propensity to bend the trunk forwards, and to pass from a walking to a running pace: the senses and intellect being uninjured.' The latter symptoms constitute the *scelotyrbe festinans* of Sauvages; and the former symptoms of the definition are not always attended by the latter. In old persons you may often observe incessant and involuntary nodding and shaking of the head, without any tendency to run forwards. There is an old woman whom I see regularly sitting in the aisle at church every Sunday: she walks to her seat slowly and steadily enough, and sufficiently upright; but her head never ceases to nod, and wag, and tremble in various directions. It may be that she is in the less advanced stage of the malady; but I have remarked her for three or four or more years, and I see no change.

Mr. Parkinson's notice was first called to the disease during his professional attendance upon a person affected by it. From observation of that case, and of several others that he subsequently met with, his account of the disorder was drawn up. He states that its first approach is insidious, and its progress often so slow and imperceptible that the patient cannot recollect precisely when it began. A sense of weakness, and a disposition to trembling, fastens on some particular part: sometimes it is the head, but more commonly it is one of the hands or arms. These symptoms gradually become more decided; and at length the morbid influence is felt in some other part. At a still more advanced period the patient is found to be less strict than usual in preserving an upright posture, even when standing or sitting, but especially when walking. By degrees he finds a difficulty in making the hand obey the dictates of the will when he is engaged in any delicate manipulation—in writing, for example; and he is obliged to walk with circumspection and care: his legs are not raised to that height, nor with that promptitude, which the will directs: so that much attention is necessary to prevent frequent falls. Then, as the malady proceeds, the propensity to lean forward becomes more strong—the centre of gravity is shifted—the patient is forced to step on his toes and forepart of his feet, while the upper part of his body is thrown so far forward as to render it difficult for him to avoid falling on his knees: in some cases he is irresistibly impelled to take much quicker and shorter steps than common, and thereby to adopt unwillingly a running pace. But the disorder does not stop here; the unhappy patient becomes unable to feed himself; or to walk at all without an attendant, who steps backwards before him, and prevents his falling forwards by the pressure of his hands against the forepart of the patient's shoulders: his powers of speech and deglutition fail; and the saliva dribbles from his mouth: he can no longer retain his urine or fæces; and at length death closes the miserable scene. In this pitiable disease there is no affection of the sensibility, no numbness, no complaint of pain, no disturbance, in its early stage at least, of the intellect. The trembling sometimes happens, as I have said, without the festination. In its full and complete form the disorder is slow, but gradually progressive. It belongs to advanced life, and is one of the various shapes, I conceive, which are assumed by senile decay.

Mr. Parkinson conjectures that it results from some chronic change of the upper part of the spinal cord, or of the medulla oblongata: but dissections are wanting to support or to refute that conjecture. Some of the patients whose cases he has given had been intemperate livers; hard drinkers: others had not been guilty of any such excesses: several had suffered a good deal from rheumatism, which he thought might have laid the foundation of their lamentable disease. But a more exact pathology of the shaking palsy is still needed. Dr. Marshall Hall observes that the symptoms have, in several particulars, a marked resemblance to the effects observed by M. Serres (and related in his *Anatomie du Cerveau*) of disease of the tuber annulare, or of the tubercula quadrigemina.

Nor have we any ascertained means of curing this disease; or rather, this state of decay. Dr. Elliotson indeed says that he succeeded in one instance (of which, however, the particulars are not given), with the carbonate of iron: but that he had tried the same medicine in vain in several other cases. We must administer to symptoms, and endeavour to set those functions right which may be obviously wrong: to regulate the bowels, to procure sleep, to nourish and uphold the patient without unduly stimulating him: and this is all that my own experience enables me to tell you of the shaking palsy.

Another analogous disorder, meriting a moment's notice, is that peculiar kind of trembling which is apt to occur in persons who are much exposed to the poisonous fumes of mercury: *mercurial tremor* it is called; and popularly, *the trembles.* It consists in a sort of convulsive agitation of the voluntary muscles, which is most violent whenever efforts are made to move the limbs by the help of those muscles; whenever, in fact, volition is brought to bear upon them. It differs therefore from the shaking palsy, inasmuch as the tremor ceases when the muscles are supported, or are not called into action. It is also more susceptible of relief by medicine. The last person in whom I have witnessed this curious affection has been twice my patient in the Middlesex Hospital, and has twice got well there. John Chattin, 33 years old, was first admitted in August, 1837. He was led into the room, walking with uncertain steps, his limbs trembling and dancing as though they had been hung upon wires. While sitting on a chair he was comparatively quiet; you would not have supposed that he ailed anything; but as soon as he attempted to rise, and to walk, his legs began to shake violently with a rapid, incessant, and irregular motion. He could neither hold them steady, nor direct them with precision. Indeed without support he must have fallen down. His arms were agitated with similar involuntary movements. His tongue was tremulous, and he spoke in a hurried, abrupt, interrupted, *staccato* manner, not natural to him. He had no fever. His pulse was 66, and soft; his skin was natural; his bowels were costive. He complained of slight nausea. At the end of six weeks he went out well, or with very slight remaining weakness of his knees, and a little occasional tremor upon unusual exertion. In June, 1839, he again presented himself, in a similar state of agitation and helplessness.

This man was a water-gilder; and had been employed in that business for 18 years. Till somewhat more than a twelvemonth prior to his first appearance at the hospital, he had been free from disease. Then he began to tremble a little; but for a fortnight before his admission the shaking had become so much worse that he could not go up stairs, nor even walk upon uneven ground. The trembling, when once brought on by efforts to move, did not cease until he sat down, or got one of his fellow-workmen to grasp his limbs tightly.

This singular disorder is produced by the agency of mercury as a poison upon the body; and especially by the absorption of that metal when raised into vapour by heat, and inhaled in breathing. It is accordingly very common among water-gilders. Water-gilding is the gilding of metals, and of silver in particular, by means of fire. It is called *water*-gilding, I believe, to distinguish it from other kinds of gilding, called gilding in *oil*. The silver to be gilded is covered with an amalgam of gold and mercury, and then is placed over a charcoal fire, by which the mercury is raised in fumes, and driven off, and the gold alone is left adhering. The metal is slightly volatile even at ordinary temperatures of the air. To these fumes the workmen are necessarily exposed; and numbers of them become affected with this tremor, which is not a common result of mercury applied to the system in other ways. The same complaint is frequent among the workmen in the quicksilver mines of Friuli and of Almaden, where the crude ore is purified by the aid of heat. In Mr. Murray's 'Hand-book for Southern Germany,' mention is made of a disastrous fire which, in 1803, raged for several weeks together in a quicksilver mine at Idria, near Trieste. The fumes of sublimated mercury filled every part of it, and occasioned diseases and nervous tremblings to more than 900 persons in the neighbourhood. Dr. Bateman relates, in the 8th volume of the 'Medico-Chirurgical Transactions,' some cases like that which I have been describing. But the best account of the disorder that I have seen is given by Merat, in an appendix to his book on the *Colique Métallique*.

Since the invention of electro-plating, which is an innocuous process, water-gilding has nearly gone out of use. The danger still remains however to the silverers of looking-glasses, the makers of barometers, and others whose occupations involve frequent contact with crude mercury.

The malady comes on sometimes suddenly, more often by degrees. The patient's power of delicate manipulation fails him: he gets to be less sure of his arms than he had been; they become tremulous, and at last shake, and, if he continue to pursue his employment, the force of the trembling goes on increasing, till at length it is so general and violent that he can persist no longer. His power of locomotion is impaired; his mastication, his speech, all his manual operations, are interfered with; he becomes unable to convey food to his mouth, and is obliged to be attended to and fed, like an infant; and by and by, if he do not quit the poisonous atmosphere, graver symptoms supervene—wakefulness, delirium, loss of memory, loss of consciousness.

As the tremor increases, the digestive organs become disordered: the appetite falls off, nausea is felt, the tongue becomes furred, and gas collects in the intestines. The patients acquire a remarkable, brown, hue; and their teeth turn black. The pulse is generally full and slow.

The time required for the production of these effects varies much in different cases; from two years to five-and-twenty. Something depends, no doubt, upon the quantity and intensity of the fumes. Chattin told us that the workmen became ill whenever they had *a large job* on hand. In both his severe attacks (and very often besides, both in him and in his companions) the mercury produced salivation. This was unfrequent in the patients observed by Merat. The duration of the complaint is considerable: it may last two or three months, or longer; and sometimes it is not completely recovered from at all. Yet it is not a fatal disorder. It is a remarkable fact—inexplicable by me—that, for the most part, the inhalation of mercurial vapour causes trembling of the muscles, while inunction of preparations of the same metal through the skin, or their administration internally, produces salivation. Yet sometimes this rule is reversed.

Although the visible affection is of the *muscles*, the mischievous operation of the poison is really upon the *nervous centres*, weakening and interrupting their natural influence. When the will is directed upon the muscles, they contract unsteadily, and with frequent remissions; their action is not sustained; and it is a general observation by all who have written upon the disease, that it is aggravated by all kinds of mental emotion, by alarm, anger, surprise. My patient's shaking was, at first, augmented by the shock of the shower-bath: and always became excessive in thundery weather. So, on the other hand, it has been noticed that whatever tends to stimulate and fortify the nervous power, does temporary good: a glass of wine for example. Chattin informed us that, while the malady was coming on, he could not get up stairs to his work without first swallowing half a quartern of gin: and that he was obliged to drink porter two or three times a day.

Tremor is *always* a token of debility. What is called tone of the muscular system is a sustained state of gentle contraction, due probably to the reflex power of the spinal cord. It is believed to be maintained by a continuous stream of nervous force; or by a succession of nervous impulses so rapidly repeated that their effect appears to be uninterrupted. When the stream fails to be continuous, or when the impulses no longer succeed each other with the requisite rapidity, the muscular fibres relax and contract alternately and briefly, and the phenomena of tremor are presented. Some of the German physiologists have illustrated this view of the matter by experiments performed upon living animals. If a motor nerve be divided, the muscles supplied by it become flaccid and lax. A strong electric force applied to the separated nerve produces convulsive contractions of those muscles: but their natural tension and firmness may be restored by a weak magneto-electric current. When the rotatory movement of the machine is sufficiently rapid, the stimuli follow each other so closely as to leave no perceptible interval between them, and the palsied muscles resume and retain their *tone*. But if the revolutions of the instrument are performed more slowly, so that the successive stimuli are separated by appreciable intervals, the muscular fibres relax in accordance with those intervals, and *trembling* occurs.

The treatment, then, of tremor, considered generally, must consist in the adaptation to the particular case of those natural agencies which tend to restore the lost tone of the body—well-chosen food, fresh air, regular exercise, and the like—and in the administration of tonic drugs, such as steel or quinine. I should expect—indeed I may say that I have witnessed in such cases—beneficial results from very small doses of strychnia. But when the tremor depends upon some known exciting cause, as in the mercurial tremor which is now before us, there is something preliminary to be done. We must, if we can, remove the patient from the further operation of the poison, and remove from the body of the patient the poison already imbibed. The first of these objects is secured by withdrawing him from the injurious atmosphere. The second may, I believe, be greatly facilitated and made complete by giving him suitable quantities of the iodide of potassium.

This is comparatively new doctrine. It was put forth in 1849 by M. Melsens in a paper in the 'Annales de Chimie et de Physique,' of which paper a translation, with some valuable prefatory remarks, was published by Dr. William Budd, in the 'British and Foreign Medical Review,' for January, 1853.

'In all cases (says Dr. Budd) of mercurial and saturnine poisoning (for the paper comprehends slow poisoning by lead, as well as by quicksilver) M. Melsens assumes, and no doubt rightly, that the metallic substance is in actual union with the affected part or parts, and is retained there in the form of some *insoluble* compound.

'According to his view, the iodide of potassium, after its absorption into the blood, combines with the metallic poison, and forms with it a new and *soluble* salt: liberates the poison from its union with the injured part; dissolves it out, so to speak, from the damaged fibre, and sets it once more afloat in the circulation.

'The new compound thus set at liberty (under the form, it is presumed, of a double iodide of mercury and potassium) he supposes to be eliminated through the kidney almost as soon as formed, in combination with any excess of iodide of potassium that may happen to be present. So that poison and remedy being both cast out together, the cure may be said, in a peculiar sense, to be radical and complete.'

M. Melsens gives some striking examples of the rapid cure of mercurial tremor by this specific treatment. In one of these cases mercury was sought for, and found, in the patient's urine, while he was taking the iodide. It is remarkable, too, that this man recovered perfectly, although he continued all the while to work at his trade as a gilder.

Surely facts of this kind, if future experience shall authenticate them, are pregnant with important suggestions. In all probability it is in the very same way that the iodide of potassium combines with and carries off the syphilitic poison, or its products, and removes, often with a rapidity almost marvellous, large venereal nodes.

There is one possible source of peril to be guarded against in this sort of cure. The poison, again set afloat, is no less a poison: and if it be suddenly reconveyed into the blood in large quantity, it may compromise the patient's safety by converting his chronic disorder into a case of acute poisoning. Dr. Budd relates an instance of what I suspect to be a not very uncommon event. A patient of his in the Bristol Infirmary was put under treatment, by the iodide of potassium in free doses, for the cure of secondary syphilis. He had taken mercury largely some time before, but none for several months. In a few days he presented all the well-known symptoms of severe *mercurial* ptyalism, although not a grain of mercury had been given after his admission.

Professor Garrod has informed me that a patient who had been salivated, but whose gums had got quite well, was put upon ten-grain doses of the iodide of potassium. In twenty-four hours he was again in a state of copious salivation. This ceased on the omission of the iodide, returned upon its resumption, but *finally departed* under its continued use. This led the Professor carefully to analyse many cases, formerly noted by him, of salivation produced apparently by the iodide of potassium, and he found that all the patients had previously gone through courses of mercurial treatment.

The caution required is that of carefully adjusting the dose, and carefully watching the effects of the remedy. You must begin with small quantities of the iodide, and gradually feel your way to larger.

When all the poison has been expelled, it may be necessary to give tonics. Even without the previous employment of the iodide of potassium, quinine has been found useful. But I have most faith in preparations of iron. My patient Chattin mended decidedly and rapidly when he began to take steel. It was not the mere avoidance of the cause of the complaint that produced the improvement, for he had been away from his work for a fortnight before he applied for admission.

To prevent this effect of mercury, the workmen should be instructed to avoid, as much as possible, inhaling the poisonous fumes, to ventilate the room thoroughly, and to pay great attention to cleanliness. I believe the furnaces may be so built that the metallic vapour shall not reach the operator. If he cannot avoid being involved in it, perhaps some sort of respirator might afford protection, that made of cotton wool for example. Glass masks have also been suggested.

Apropos of this subject, I find in Mr. Sullivan's account of Ceylon ('The Bungalow and the Tent') the following statement: 'Cinnamon is known to possess particular properties as an antidote to the destructive effects of mercury; and the miners and purifiers of the quicksilver mines in Mexico and South America consume by far the larger portion of the cinnamon crop in Ceylon.'

Of almost all those morbid conditions of the nervous system which we have had so long under our consideration, the most prominent and significant symptoms have been furnished by the voluntary muscles; upon which the nervous centres, by means of the nerves associated with them, play at all times the harmonies of health, or the discords of disease. The muscles themselves have been healthy and sound. But I have now to describe to you a malady which, simulating to careless observation a nervous form, consists in disease of the muscles themselves. I do not say that it is independent of morbid changes in the nervous system; I do not think so, for reasons which I shall presently give you; but it is independent of disease in those portions of the nervous system which the muscles in their healthy movements are accustomed to obey. The affected muscles are spoiled in texture; undergo a change similar to that which I described in an early part of the course as fatty degeneration, and the change is strictly limited to the *voluntary* muscles of the body. They are found, upon microscopic examination after death, to be decayed, or decaying; more or less pale, yellowish, streaky, thin, and wasted; the fleshy fibres lost, or converted into oil globules and granular matter. In the consummate stage of the disease the muscle is dead and gone.

The disorder is not a common one, and it belongs to modern nosology. It was foreshadowed by my former colleague, Sir Charles Bell. Instances of it are described by earlier English writers, who imperfectly comprehended its nature. M. Cruveilhier, and other foreign pathologists, have also recognised and studied the disease. In the thirty-fifth volume of the 'Medico-Chirurgical Transactions' you may read a very interesting paper on the subject by Dr. Meryon, in which he gives an account of the disorder as he had witnessed it in several members of the same family. In 1858, Dr. Roberts of Manchester published a most admirable essay on this malady, to which he gave the name of *Wasting Palsy.* He incorporated in this essay the amount of his own experience of the disease, with the facts and opinions which he had collected from previous writers; discussing the whole subject with great clearness and ability. He has since contributed an article upon it to the 'System of Medicine,' published under the editorial care of Dr. Russell Reynolds; wherein he reviews, and in some respects modifies, the conclusions which he had previously been led to form. These two papers, taken together, contain a very complete and rich summary of what is known respecting wasting palsy; and from this source, for your information and guidance, I must needs borrow largely.

There are strong reasons for believing that the muscular atrophy is due, in some instances at least, to pre-existing mischief in the *sympathetic* portion of the nervous system; which consists, as you know, in a chain of ganglia distributed throughout the trunk of the body, connected by nervous filaments with each other and also with the spinal cord; and which appears to govern the processes of nutrition through the medium of the vaso-motor nerve fibres.

We must exclude, in these cases, the operation of other well-known causes of fatty atrophy of the muscles. It is not produced by a defective supply of nutritive blood, in consequence of disease in the arteries; nor by mere disuse of the muscles. Such arterial disease has been searched for, but has not been found, after the death of the patient. The skin of the corresponding part, and the connective tissue, which would both suffer equally with the muscles from such a cause, remain natural and healthy.

The earlier investigators of this disease discovered no changes in the spinal cord, or nervous system generally, to account for it. But the more strict methods of recent microscopic inspection tell a different tale. In not a few of these cases unequivocal evidence of structural disorganisation has been detected in the cord, by Dr. Gull and Dr. Lockhart Clarke, in this country, and by several pathologists on the Continent. The morbid condition is sometimes partial and of limited extent, and may very easily be overlooked. It must be confessed that the positive results of these minute and thorough explorations of the nervous tissues vitiate all previous conclusions by less skilled or less accurate observers respecting disorders supposed by them to be purely functional. Now this not unfrequent association of disease within the cord, and wasting of the muscles, cannot be regarded as an accidental coincidence. Neither can the relation of the two as cause and effect be, in my judgment, for a moment questionable. We see, by no strained inference, how the nervous may induce the muscular changes. The history too of some of the recorded instances of the disease is very significant. Thus, a coal-waggoner, a hospital patient of Dr. Gull's, became gradually the subject of atrophy in various muscles of the hands and arms, neck, shoulders, and back, after having been forced backwards from his seat, and striking his head against a beam, while driving under a low archway. He died some three years after the time of the accident. Exudation of granule cells was found abundant in portions of his spinal cord. In another of Dr. Gull's patients, a boy of fifteen, wasting of the muscles of the trunk and upper limbs followed a playful blow with the fist of one of his companions between his shoulders. 'In a youth under my care at the Manchester Infirmary,' writes Dr. Roberts, 'who ultimately died from implication of the respiratory muscles, the first symptoms of atrophy in the ball of the right thumb occurred six months after the fall of a bale of cotton cloth on the nape of the neck. The immediate effects of the injury were confined to slight stiffness of the neck, and occasional pains extending down the arms.' Valentiner records a case in which the first failure of health followed a fall on the back from a height of eight or ten feet; yet the atrophy did not appear till six years after. In a remarkable case, reported by Dr. Thudicum and Dr. Lockhart Clarke, a gentleman, aged fifty-four, suffered what he considered a slight injury. In jumping across a flower-bed for a wager, he came down heavily on his heels, and then fell backwards upon his head. He was stunned for a time, but gradually recovered, and after some days' confinement to his bed, appeared to be quite well again. It was, however, soon perceived that a great change took place in his habits. Having been extremely fond of manly sports and exercises—rowing, cricketing, riding on horseback, dancing, and the like—he discontinued to take part in any of these, although he continued to go every autumn to the Scotch moors for the purpose of shooting grouse. Five years after the above-mentioned accident, while engaged in this last-named sport, he perceived that his right leg had lost a part of its usual strength. From this time gradual atrophy and loss of power in the muscles crept over the patient, until at last death took place from failure of the respiratory muscles. Widespread degeneration of the spinal cord was found after death.

Other causes have been assigned as capable of producing wasting palsy: *excessive use* of the affected muscles—exposure to *wet and cold.* Whether these are real causes, except in so far as they may operate first upon and then through the nervous system, I do not venture to determine. Certainly in some instances the tendency to the disease is inherited. Dr. Roberts collected the history of ten families in each of which the hereditary disposition was notable. In one of Dr. Meryon's cases, four boys of the same family suffered under the complaint, while their six sisters remained healthy. In another family mentioned by him, consisting of four children, the two boys were affected, and the two girls escaped.

The symptoms and clinical history of this grave disorder present much that is very curious and interesting.

I have told you that the wasting is peculiar to the voluntary, striped, muscles of the body—the muscles of what is called the life of relation. But the voluntary muscles are not all equally subject to the malady. Its danger is proportionate to its extent—in other words, to the number of muscles ultimately implicated. In most cases it begins in the upper limbs, most frequently of all in the hand, in the ball of the thumb especially, and in the ball of the right much more often than of the left thumb. Next to those of the hand, the muscles of the shoulders are apt to be the earliest affected: sometimes those of the neck and face: less often some of the muscles of the lower limbs are the first to suffer. There seems a kind of caprice in respect of the starting-point; but you will take notice that the muscles of which I have been speaking are just the muscles which ordinarily are the most employed by working men—a fact which lends strength to the doctrine that the disease is brought on sometimes by overmuch work. In all cases the process of decay is gradual; it is not always even continuous, but marked by pauses and recommencements. Dr. Roberts lays just stress on a distinction between what may be regarded as two forms of the disease, the *partial* and the *general.* 'In the immense majority of cases,' he says, 'the disease is permanently limited to one or a few groups of muscles in the upper or lower extremities; in other cases, and these are by far more formidable, the atrophy invades successively the voluntary muscles of the entire body, trunk and extremities. The only muscles which, as yet, have not been known to be attacked, are those of mastication, and those which move the eyeball. When the atrophy is confined to certain regions of the extremities, the life of the sufferer is not imperilled; but when the trunk is invaded, and the muscles of respiration participate in the disease, death by suffocation is the ultimate result.'

In its advance, the disease is marked by the supervention of various and singular deformities. The decrease and ultimate destruction of the muscular tissues about the hand leads sometimes to a powerless dropping of the wrists, sometimes to a remarkable condition in which the hand comes to resemble the crooked claw of a bird. The plump, cushion-like surface of the palm disappears, and the radiating flexor tendons stand out in strong relief, with deep fissures between them; while 'the back of the hand is hollowed out in long furrows, corresponding to the inter-osseous spaces, and the first joints of the fingers are pulled backwards, giving the hand a broken-backed appearance.'

So, when the disease commences about the shoulders, the wasted muscles lose their power, the arm dangles helpless at the patient's side, the scapula perhaps is no longer supported by the serratus magnus, its lower angle is tilted upwards, and the outline of the chest is strikingly distorted. When the muscles of the neck are involved, the head falls either forwards, or laterally towards one shoulder. As the wasting may, and often does, affect certain muscles of the forearm only, or certain muscles of the upper arm only, this want of uniformity in the distribution of the disease produces a corresponding disfigurement of the limb. Very remarkable again are the alterations produced in the face when the muscles of expression are destroyed. Dr. Roberts describes it as being 'veiled, as it were, by an impenetrable mask; no emotion changes its unvarying aspect; the expression is always solemn, stolid, and unmoved. The muscles of the eyeballs, however, are spared. The oral and buccal muscles are usually invaded early, and the saliva dribbles over the lips.'

'When the abdominal muscles are implicated, the lumbar curve is enormously exaggerated by the unopposed action of the erector spinæ, and the belly projects in front, while the chest is thrown back as a counterpoise. The invasion of the lingual muscles leads to a falter in the speech, and to imperfect comminution of food in the mouth. The involvement of the laryngeal muscles produces a change in the voice, which loses its register, and is finally reduced to a monotone. When the diaphragm and intercostals are reached, violent suffocative fits of coughing are occasioned; the play of the chest is at length so reduced that a slight additional difficulty to respiration proves fatal. Dissolution is usually brought about by a bronchial seizure; the air-tubes are speedily clogged with mucus, which no efforts of the patient can dislodge, and rapid asphyxia closes the scene.'

With all this, in uncomplicated cases, there is no impairment of the general sensibility. But in many instances severe neuralgic pains are complained of—a further mark of the neurotic element of the disorder.

Dr. Roberts states that the affected muscles sometimes 'exhibit singular vibratile tremors, fugitive wavy oscillations of the muscular fibres, visible under the skin, but not producing any movement of the limb,' neither are the patients themselves aware of them. They show this at least, that the muscle is not yet wholly dead. They cease when the progress of the disease stops; and when the atrophy has become extreme.

Wasting palsy is not confined to any period of life, but it is much more common in young adults, and in middle-aged persons, than in children or in those who are aged; much more common also in the male sex than in the female; and this peculiarity seems to prevail even in cases where a tendency to the disorder has been plainly transmitted by inheritance.

In wasting palsy the prognosis can never be securely good. The *general* form of the disease is almost of necessity fatal. This form is most to be apprehended, according to Dr. Roberts, when the malady seems traceable to the influence of cold; also in those cases in which the wasting begins in the lower limbs. The *partial* form sometimes stops; perhaps may be sometimes in a certain degree remedied; but it is apt to make a fresh start even after a pause of some continuance.

In respect of this, as of analogous disorders, it is well to search in every case for evidence of present or of bygone syphilis; and, if such evidence be found, to give the patient the chance of benefit from a course of the biniodide of mercury.

It seems consistent with sound reason also, that when the disorder seems attributable to overtasking of the affected muscles, they should be permitted absolute repose. Meanwhile, those remedies should be tried which are supposed to promote the nourishment and repair of nerve tissue: fats—cod-liver oil in particular—preparations containing phosphorus.

Instances not a few have been recorded by Dr. Roberts, Duchenne, and others, in which the partial form of the disorder has apparently been arrested, and strength has been renewed in the failing muscles, by the frequent passage through them of a magneto-electric current. Sometimes an interrupted current from a galvanic battery has been found more effectual. In cases so anxious and uncertain, the one or the other of these modes of applying electricity should never fail to be steadily and scientifically put in operation. The object is to keep the muscles in frequent exercise—to prevent their further waste from mere disuse—till, peradventure, hurt nerve-tissue has had time to repair itself, and the lacking nerve-force is restored.

For the severe neuralgic pains which afflict many of these unhappy sufferers, the hypodermic injection of morphia is the fitting and priceless alleviation.

I proceed to the subject of *hysteria*: a subject highly interesting and important, as well as obscure and difficult. I scarcely know how to arrange what I have to say, so as to present the disorder to your notice in the most intelligible manner. Hysteria has characters peculiar to itself: but it is apt also to assume the form, and mimic the symptoms, of various other diseases of a much graver nature. If we are not capable of distinguishing the true malady from that which is its double, we shall be constantly committing most serious mistakes in the prognosis, to our own discredit and damage; and in the treatment, to the injury of our patient. I shall first attempt to describe to you the phenomena which are peculiar to hysteria; and then to point out the class of persons who are most subject to it; and afterwards I shall briefly advert to the imitative freaks which we are almost daily witnessing in hysterical constitutions, and to some other points connected with this extraordinary complaint.

I need not tell you that the hysterical *paroxysm* (for the disease is paroxysmal) is almost, though not exclusively, confined to women. It occurs under a great variety of forms, but they may all be reduced, for convenience of description, to two. The first of these has a general resemblance to an epileptic fit. The trunk and limbs of the patient are agitated with strong convulsive movements: she struggles violently, like a person contending; rises into a sitting posture, and then throws herself back again; forcibly retracts and extends her legs, while her body is twisted from side to side: and so powerful are these muscular contortions that it often is all that three or four strong persons can do to restrain a slight girl, and prevent her from injuring herself or others. The head is generally thrown backwards, and the throat projects; the face is flushed; the eyelids are closed and tremulous; the nostrils distended; the jaws often firmly shut; but there is no *distortion* of the countenance; the cheeks are at rest, unless when, as often happens, the patient is uttering screams or exclamations. If the hands are left at liberty, she will often strike her breast repeatedly and quickly, or carry her fingers to her throat, as if to remove some oppression there; or she will sometimes tear her hair, or rend her clothes, or attempt to bite those about her. With all this, her breathing is deep, labouring, irregular; and the heart palpitates. After a short time this violent agitation is calmed: but the patient lies panting and trembling, and starting at the slightest noise or the gentlest touch; or sometimes she remains motionless during the remissions, with a fixed eye; till all at once the convulsive movements are renewed: and this alternation of spasm and quiet will go on for a space of time that varies considerably in different cases; and the whole attack frequently terminates in an explosion of tears, and sobs, and convulsive laughter.

There is a *variety* of this form of hysterical paroxysm, in which the patient suddenly sinks down insensible, and without convulsions: with slow and interrupted breathing, a turgid neck and flushed cheeks; and she recovers from that condition, depressed in spirits, fatigued, and crying.

You will observe that the symptoms I have been enumerating belong to the nervous system; and indicate great derangement in the functions of animal life. In the other of the two forms to which all the various modifications of the attack may be reduced, the principal marks of disturbance are referrible to some of the viscera. The patient experiences a sense of uneasiness in some part of the abdomen, frequently towards the left flank; a ball appears to roll about, and to rise first to the situation of the stomach, and then to the throat, where the patient feels a choking sensation; the action of swallowing is frequently repeated; the abdomen becomes distended with wind, loud rumblings and sudden eructations take place; there is much palpitation of the heart, the patient is sad and sorrowful, and prone to shed tears.

After the paroxysms, these patients commonly void a large quantity of limpid, pale urine, looking almost like water; and this is sometimes expelled during the fit.

Such is a brief, and, I am aware, incomplete account of the hysterical paroxysm. It sets forth, however, in outline, the two principal varieties of the attack: and you are to observe that the last, the quieter form, is often the prelude to the convulsive; but it not seldom also occurs alone, and then is as indicative of hysteria, as the *petit mal*, to which it is somewhat analogous, is of epilepsy.

And before I go any further, let us again enquire into the circumstances which distinguish the *paroxysms* of those two diseases, epilepsy and hysteria. I have shortly adverted to these discriminative circumstances before; but we shall be better able to appreciate them, now that the main features of each diseased state have been under our consideration. It is of great importance to be able to render the diagnosis certain and accurate. It is a dreadful announcement to have to make to a father or a mother that their child is epileptic; whereas hysteria, though it is sufficiently distressing, is attended, in nine hundred and ninety-nine cases out of a thousand, with no ultimate peril, either to mind or body. In some instances the diagnosis is perfectly easy: in others it is dubious and full of anxiety. Whenever you fail to satisfy yourselves completely as to the nature of a given case, you will do well, in legal phrase, to give your patient the benefit of your doubt, and acquit her of epilepsy; or pronounce her guilty of the minor offence of hysteria.

The points of resemblance, and the points of distinction, belonging to the hysterical and the epileptic paroxysm respectively, have been very clearly summed up by Foville.

There are two principal forms of each disorder. In each, one of these forms is convulsive, and the other is not. The non-convulsive form of epilepsy relates exclusively to the sensorium: it is characterised by vertigo, and by a suspension (however brief and transitory) of the mental powers. The non-convulsive form of hysteria has little apparent connection with the animal functions: its palpable phenomena consist in derangement of the organic functions of the thorax and abdomen. It is the ganglionic portion of the nervous system that seems chiefly disturbed.

In the epileptic *fit* there is an entire loss of consciousness. The patient, on emerging from the paroxysm, recollects nothing of what has been going on during its continuance. It is not so in the hysterical fit. The loss of consciousness is very seldom complete: and it never occurs at the outset of the attack. The patient often is able to repeat (though she may not always choose to confess it) what has been said by the bystanders during the period when she seemed insensible. This is a point of distinction well worth remembering, for more reasons than one. It not only helps the diagnosis when the fact comes out; but it suggests certain cautions to ourselves. We must take care not to say anything by the bed-side of a hysterical patient which we do not wish her to hear: and we may take advantage of her apparent unconsciousness, and pretend to believe in it, and speak of certain modes of treatment which she will not much approve of, but the very mention of which may serve to bring her out of the fit.

In the epileptic paroxysm the face is usually livid; and foam, which is frothy with air, or red with blood, escapes from the patient's mouth. These are symptoms which we do not see in the fits of hysteria. The convulsive movements, even, offer some characteristic shades of distinction. In epilepsy they are commonly more marked on one side of the body than on the other, and less irregular: the same movements are rapidly repeated: there is a strangling rattle in the breathing: while in hysteria the forcible flexion and extension of the limbs, and the contortions of the trunk, are more sudden, and, as it were, capricious; the respiration is deep, sighing, mixed with cries, and sobs, and often with laughter. But, perhaps, the convulsive motions differ most in the face. The epileptic expression is usually frightful: the eyelids half open, the eyeballs rolling, the mouth drawn to one side, the teeth grinding, the gums exposed by the retraction of the lips, the tongue protruded and bleeding, the complexion leaden; while in hysteria the cheeks are red, but at rest; the eyelids are closed and trembling; if you raise the upper one, you will see the eye fixed, perhaps, but it is bright, and very different from that of the epileptic, which, if it be not rolling, is dull, projecting, and the pupil usually dilated.

Foville affirms that when, besides a sudden loss of consciousness with convulsive movements, there are also lividity of the face, and an escape of frothy saliva from between the lips, and the convulsions are more pronounced on the one side of the body than on the other, the disease is epilepsy, and not hysteria: and I think he is right.

By Dr. Marshall Hall the grand distinction between the two diseases is stated to be this:—that in hysteria, much as the *larynx* may be affected, it is never closed; in epilepsy, it *is* closed. Accordingly in the former we have heaving, sighing inspiration; in the latter, violent ineffectual efforts at expiration. In the very outset of the epileptic paroxysm the respiration, I believe, is thus suspended.

The hysterical seizure may be over in a quarter of an hour, or in less time than that; or it may last many hours, or even several days.

The hysterical seizure is almost peculiar to women: and it seldom occurs in them except during that period of their lives in which the menstrual function of the uterus is, or ought to be, in activity. In this country it is most apt to occur between the ages of fifteen and forty; and in the vast majority of patients who do suffer it, you will find some marked derangement of that particular function. These facts alone afford a strong corroboration of the ancient theory, which ascribed the whole of the phenomena to uterine disorder; and *named* the disease accordingly. You will hear or read of disputes as to whether the womb, with its appendages, or the nervous system, is the seat of hysteria. But such disputes are merely verbal, I conceive. No doubt the convulsive movements, and the mental affection, and the morbid sensations, depend upon some unnatural condition of the brain and nerves; but it does not follow that the disease originates in that unnatural condition. We know that the uterus, or the ovaries, cannot of themselves determine the muscles to contract; but if they be in an unhealthy state they may act upon the muscles through the *medium* of the nervous system: and such I take to be the fact. *How* they do so we no more know, than we know how the little finger is bent when we resolve to bend it.

But, say some, we every day meet with diseased conditions of the uterus and ovaries—amenorrhœa, dysmenorrhœa, menorrhagia, even disorganisation—without any of these nervous symptoms. True; and we cannot always fathom the mystery of this. But one thing is certain, that there exists in some persons a much greater readiness to take on the disease, upon the application of the exciting cause, than in others. This predisposition I have had occasion to advert to again and again, since I began to speak of the *spasmodic diseases* of the nervous system. Such diseases occur in certain individuals only; and in these individuals there pre-exists a peculiar condition of the nervous system, 'for which,' says Dr. Alison, 'we have no more precise or definite expression than *nervous irritability*, or *mobility*; a condition which is more common in women and children than in men; and more common in all persons when in a state of weakness, than when in the full enjoyment of muscular strength; in women, particularly, more common about the menstrual periods, and immediately after delivery, than at other times; more common likewise in those in whom the monthly discharge is habitually *excessive*; or *altered*, as in *leucorrhœa*; or suddenly *suppressed*, or more gradually obstructed in the different forms of *amenorrhœa*; than in others. In this condition of mobility, both sensations and emotions are intensely felt; and their agency on the body is stronger and more lasting than usual; continued voluntary efforts of mind, and steady or sustained exertions of the voluntary muscles, are difficult, or impossible; the muscular motions are usually rapid and irregular, and the "animus, nec sponte, varius et mutabilis."' In persons of this moveable temperament, spasmodic complaints are easily excited: and the tendency to their recurrence is increased by each repetition of them.

Now the persons who suffer hysteria are of this class. They are commonly young women, in whom the process of menstruation is in some way or other disordered; and who either are naturally of a feeble constitution, or have been debilitated by disease, or by their habits of life. Often they are pale; have cold hands and feet; are subject to chilblains; eat but little, and do not fancy meat, which they sometimes absolutely dislike and refuse; or their taste is depraved and capricious; they will devour wax candles, wafers, chalk, sealing-wax, slate pencil, and similar trash. And what is very curious and characteristic, although they often abstain almost entirely from animal food for weeks or months together, and take very little nourishment of any kind, they do not in general emaciate. You might expect that, under such a mode of life, they would waste away: but they continue round, and plump, and smooth. Some of them are even ruddy.

And belonging to women of this peculiar constitution there is one other very remarkable feature, which it behoves us to make ourselves thoroughly acquainted with. Almost any part of the body, in these persons, is liable, under the influence of slight causes, and even without any obvious cause, to fall into a disordered state of action and suffering more or less resembling that which inflammation or organic disease might excite in the same part.

This is a most important fact; because if we erroneously ascribe symptoms which really result from inflammation to mere nervous or hysterical disorder, we may suffer the patient to perish for want of appropriate measures that might have saved her; and on the other hand, if we apply to these nervous, imitative, hysteric complaints, the treatment proper for inflammation, we shall generally, indeed, relieve our patient for the time; but we shall leave her more prone to the nervous affection than before, and permanently damaged by our mischievous activity.

I say that almost every kind of serious disease may be mimicked by what we must call hysteria. And your skill will sometimes be severely tasked to determine the true import of the symptoms, and the real nature of the case.

One of the diseases which is very often copied by hysteria, is *inflammation of the peritoneum*. You will find a patient complaining of acute pain in the abdomen, aggravated by the slightest pressure; and she shall have, perhaps, a hot skin, a quick pulse, and a furred tongue. When you meet with such symptoms in a young female, in whom there is any derangement or irregularity of the uterine functions, you will do well, before you cover her abdomen with leeches, to ask yourselves whether all this suffering may not be simply nervous. Search into her previous history as narrowly as you can. If you find that she has had similar attacks before; if she have been known to suffer hysterical fits; and if the tenderness be excessive, and, as it were, superficial, felt upon the slightest touch as much as when firmer pressure is made, you may generally spare the blood-letting, purge the patient well, and cause an asafœtida enema to be thrown into the rectum; and in a few hours you will find that the peritonitis has vanished.

Among the pains which infest females of the hysteric constitution, and which are apt to be erroneously ascribed to inflammation, *stitches and pains in the hypochondria* are probably the most common. They are oftener complained of in the left hypochondrium than in the right. These things are much more generally understood now than they used to be even a few years ago. I cannot tell you how many persons I have seen who had been diligently treated with leeches, and blisters, and blue pill, for supposed chronic inflammation of the liver or spleen, or still more actively depleted for presumed pleurisy or pericarditis, when no such inflammation existed, and when the treatment, by reducing the strength, tended to rivet upon the patient that mobility of system which was the chief predisposing cause of the pains.

Pains of this kind are believed by Dr. Inman of Liverpool to be muscular pains, and to result, often, from over-exercise, or unusual exercise, of particular muscles. Such pains, he observes, are attended by increased sensitiveness of the skin that lies over the affected muscle, and are relieved by steady continuous pressure. He cites many cases in illustration of this sort and source of pain. One is of a lady who, on a wet Sunday, walked a long way to church on tiptoes, to save a new dress and petticoats. The walk was followed by acute pain in the back part of both legs. So pains in one side have been traced to the novel and active use of the croquet mallet. You will do well, when you hear complaints of similar pains, to search for this possible cause and explanation of their occurrence. They are most apt to present themselves in persons whose general health has been somehow reduced below its general standard.

You would scarcely suppose that *palsy*—decided hemiplegia or paraplegia—could be simulated by hysteria: yet this certainly is the case; and I have seen instances of it even among hospital patients. They are difficult and perplexing cases. The sudden occurrence of the paralysis, with no corresponding affection of the face or tongue, and without any of the other symptoms which commonly mark the real disease, its sudden disappearance, and, above all, the supervention of a hysterical paroxysm, will often disclose the true nature of the disorder. Dr. Todd asserts that in hysterical hemiplegia (which is generally incomplete) the patient drags the palsied leg along the floor after her as if it were dead, with a *sweeping* motion, without endeavouring to lift it, and without that swinging-round movement of the limb observable in those who are hemiplegic from organic disease of the brain. Paraplegia, again, coming and departing with like suddenness and caprice, is no unfrequent shape assumed by this changeful malady. The sensibility of the lower limbs is often impaired in these cases as much as, or even more than, their muscular power.

Hysterical affections referred to the throat are very common. *Aphonia*, for example: the voice being lost on a sudden, and recovered as suddenly. Mock *laryngitis*. I remember being asked by Sir Charles Bell some years ago to see a young woman in the Middlesex Hospital under his care. She had recently arrived, and was breathing with the stridulous noise peculiar to inflammation of the larynx. She had twice before, in the country, had tracheotomy performed for similar attacks; and there were the scars of the operations on her neck: but both Sir Charles and myself were satisfied, upon considering all the circumstances of the case, that the difficult inspirations were spasmodic and hysterical; and she recovered under the remedies which do good in hysteria. Inability to swallow, *dysphagia*, is another of the hysterical vagaries relating to the parts about the throat. Dr. Bright has a very instructive case of that kind. A patient was sent to Guy's Hospital for stricture of the œsophagus. It was stated that the difficulty of deglutition had existed for several weeks, and was increasing. The surgeon under whose care she was admitted was instantly struck by certain circumstances which did not seem to consist very well with the notion that there was organic disease. Her appearance belied it, and her age. But he thought it right to examine the œsophagus by means of a probang; and no sooner was the instrument introduced, than the patient went into a hysterical fit, which was followed immediately by hysteria in several females in the same ward. The complaint turned out to be nothing but a hysteric constriction, and was soon completely removed.

Surgeons are familiar with the 'hysterical breast.' The mamma becomes painful, tender, enlarges somewhat perhaps. The girl fears that a cancer is breeding. She communicates her alarm to her friends, and a medical man is consulted. If he happen to be timid and inexperienced, he makes matters infinitely worse by applying leeches and fomentations; by examining the breast at every visit; and by keeping the patient's attention anxiously fixed upon it. Whereas the treatment ought to be directed to the state of the general system; and the local uneasiness spoken lightly of, or disregarded.

Among the hysteric affections of the air-passages, there is a peculiar kind of *cough* which you ought to be acquainted with. It is loud, harsh, dry, more like a bark, or a hoarse bleat, than a cough. Sometimes it is incessant, sometimes it occurs in paroxysms which, I verily believe, are more annoying to hear than to perform. Hysterical affections of the diaphragm, again, are by no means rare. I had a very obstinate case of that sort in one of my hospital patients. She would sit in her bed all day long, uttering every eight or ten seconds a loud and most discordant *hiccup*. And I remember an out-patient, who presented a picture of perfect health, and who came week after week, to be cured of what I could consider nothing but a hysterical *eructation*: it was continual and distressing, and prevented her from obtaining any employment as a servant. Hysterical *vomiting* is also frequent, simulating cancer of the stomach. Nay, hysterical *hœmatemesis*. A romantic girl was for some *months* under my care in the hospital with that complaint. She vomited such quantities of dark blood (which did not coagulate, however), as I should not have thought possible if I had not seen them. Day after day there were potfuls of this stuff: yet she did not lose flesh, and she menstruated regularly; and what was very curious, the vomiting was always suspended during the menstrual period, and recurred again so soon as the natural discharge ceased. I said she was romantic; but I should rather have said that she had that peculiar mental constitution which belongs to hysterical females. She used to write me long letters of thanks for my attention, though I was heartily tired of her: and these were couched in all the fine language of the Minerva press. At last I sent her away; just as bad as when she came into the hospital. Five or six years afterwards she called at my house with a present of some game, and told me she had got married to a hair-dresser, and was quite recovered.

There is a kind of sanguineous *expectoration* belonging to young women of this class, and very likely to mislead the unwary. I meet with two or three instances of it every year. The patient exscreates daily, or at irregular intervals, a thinnish fluid something like saliva, more or less tinged and streaked with brown or florid blood. A young hand investigates diligently the source of the bleeding, and puzzles himself to determine whether the case be one of *hœmatemesis* or of *hœmoptysis*. Nine times out of ten it is neither the one nor the other. The blood comes from the mouth or the fauces; and is sometimes the result of self-inflicted scratches.

Hysterical affections of the *joints* are common also. A young girl became my patient in the hospital for some trifling ailment, and after a short time she began to complain of great pain in her knee and hip; she could not stand upon the limb, nor bear to have it moved or touched. I got Sir Charles Bell to see her: he was so satisfied as to the nature of the case—so convinced that it was a genuine example of inflammation and ulceration of the hip-joint—that he gave a little lecture to the pupils who stood round the bed, upon the characteristic position in which the patient lay; and he took her into one of the surgical wards to be under his own care. Some time afterwards I had occasion to go into that ward, and there I found my former patient with her heel drawn tight up against her buttock. It turned out that she had had no serious disease of the hip at all; both the pain, and the rigid contraction, gave way under measures which could have done no good to an ulcerated joint. I think the first clue to the real nature of her malady was the occurrence of a fit of hysteria. Sir Benjamin Brodie says, that among the higher classes of society, at least four-fifths of the female patients who are commonly supposed to labour under diseases of the joints, labour under hysteria, and nothing else.

We have a conclusive test of the real nature of these cases of contracted limbs in the effect upon them of the inhalation of chloroform. With the insensibility so produced comes at once complete relaxation of the hysterical member. This, however, is a test to which I would not have you wantonly or needlessly resort.

Another prank belonging to hysteria, and one against which it is very necessary that you should be on your guard, is that of mimicking disease of the bones of the spine. The patient complains of pain and tenderness at certain points in her back, and of weakness probably in her lower limbs; and it is now become notorious that scores of young women have been unnecessarily confined for months or years to a horizontal position, and have had their backs seamed with issues, for supposed disease of the bodies of the vertebræ, who had really nothing the matter with them but hysteria, and who would probably have soon ceased to complain if, instead of being restricted to that unnatural imprisonment and posture, they had taken a daily gallop on horseback.

It is curious enough to notice how the mind is apt to become affected in some of these cases. After the patient has been lying supine for some weeks, she *is* unable to stand or walk, simply because she *thinks* she is unable. The instant she makes a fair effort to use her limbs again, she can and does use them. Her condition is at once reversed. *Potest quia posse videtur.* Dr. Corfe, the present apothecary to the Middlesex Hospital (1847), has no little trouble with patients of this kind; but he generally succeeds in *making* them walk, and in convincing them, as well as himself, that they may do so with impunity. Sometimes, though ordinary authority may not be efficacious in this respect, some stronger influence prevails. A lady told me not very long ago that an acquaintance of hers, a member of a family of distinction, had been lying I know not how long on her back; that position having been prescribed to her by some medical man for a presumed disease of the spine. She lost all power of using her legs; but she got quite fat, as, indeed, well she might, for her appetite was remarkably sharp, and she lived chiefly upon chicken; and the number of fowls she devoured was incredible. She lived at some little distance from town, and at last Sir Benjamin Brodie was sent for to her. Now Sir Benjamin, to use a vulgar phrase, is *up* to these cases; and he wished to see her *try* to walk: but she declared that the attempt to do so would kill her. He was resolute, however, and had her got out of bed: and in a few days' time she was walking about quite well, and very grateful to him for his judgment and decision. A medical man of less name, or of less determination, would probably have failed. Dr. Bright has a good example of a somewhat similar kind; showing the power of another form of influence. He was asked to see a young lady who had been confined to her bed for nine months. If she attempted to move she was thrown into a paroxysm of agitation, and of excruciating agony, affecting more particularly her abdomen. She had almost lost the use of her lower limbs; and she and her friends seemed to have given up all hope of her restoration. But she presented no appearance of important disease; her countenance bore no marks of visceral mischief; nor was it possible to discover any proof of organic change. Dr. Bright set the case down in his own mind as one of hysteria. She was thought to have derived relief from some stimulating injection, and from certain pills. As her friends were in moderate circumstances, Dr. Bright talked seriously to the mother, and recommended that simple water should be employed for the injection, and that bread pills should be substituted for those the girl had been taking. The mother soon perceived that these means produced the same tranquillising effects on her daughter which had hitherto been ascribed to the medicine. 'My visits,' he says, 'became less frequent; I was absent a fortnight: on my renewing my visit, no change had taken place. I attempted to get her shifted gently from the bed to the sofa, but it was impossible; the paroxysm almost overcame her. Once (after having attended altogether about nine months) I called after an absence of nearly a month; her sister met me at the street-door with a smiling face to tell me that our patient was quite well: and on enquiry, she related how, three mornings before, under a *deep religious impression*, she had completely recovered all her powers; and I found her sitting up, working and amusing herself as if she were completely convalescent from some ordinary illness.'

Southey, in one of his published letters, speaking of his mother, says:—'While she was a mere child she had a paralytic affection, which deadened one side from the hip downward, and crippled her for about twelve months. Some person advised that she should be placed out of doors in the sunshine as much as possible; and one day, when she had been carried out as usual into the forecourt, in her little arm-chair, and left there to see her brothers at play, she rose from her seat, to the astonishment of the family, and walked into the house. The recovery from that time was complete.'

These are the cases which suit the purposes of miracle-mongers. A few years ago all the journals belonging to a certain party in the religious world were full of an instance of miraculous cure. The patient was a young woman; her legs had been paralytic, or contracted, I forget which; some enthusiastic preacher had influence enough with her to make her *believe* that if on a certain day she prayed for recovery with a strong faith, her prayer would be successful, she would recover at once; and she did so. No one can doubt that it was just such a case as those I have now been mentioning. Many of these pseudo-diseases terminate suddenly under some strong moral emotion. A fall—a fire in the house—any overwhelming terror, will sometimes put at end to them. And where the joints have been the parts affected, several patients have declared that they felt a sensation as if something had snapped or given way in the part, immediately before the sudden recovery took place.

'As might be expected,' says Sir Benjamin Brodie, 'similar cures have been furnished by mesmerism and by homœopathy.'

Some of the shapes assumed by this pathological Proteus are hideous and disgusting. Paralysis of the muscular fibres of the bladder, or spasm of its sphincter, sometimes really occurs, sometimes is only aped, in hysteria. It is a common trick with these patients to pretend that they labour under *retention of urine*; and that, although the bladder is full, they cannot make water. The daily introduction of the catheter by a dresser or surgeon's apprentice appears to gratify their morbid and prurient feelings. Sometimes, no doubt, the difficulty is real; but it is oftener feigned or exaggerated. I have again and again known it disappear upon the patient's being left, without pity, to her own resources. But girls have been known to drink their urine, in order to conceal the fact of their having been able and obliged to void it. The state of mind evinced by many of these hysterical young persons is such as to entitle them to our deepest commiseration. The deceptive appearances displayed in the bodily functions and feelings, find their counterpart in the mental. The patients are deceitful, perverse, and obstinate: practising, or attempting to practise, the most aimless and unnatural impositions. They will produce fragments of common gravel, and assert that these were voided with the urine: or they will secrete cinders and stones in the vagina, and pretend to be suffering under some calculous disease. A young woman contrived, in one of our hospitals, to make the surgeons believe that she had *stone in the bladder*: and she actually submitted to be placed upon the operating table, and to be tied up in the posture for lithotomy, before a theatre-full of students; and then the imposture was detected. Sometimes they simulate *suppression of urine*, and after swallowing what they have passed, vomit it up again, to induce the belief that the secretion has taken place through the new and unnatural channel.

It is impossible, I say, not to pity the unhappy victims of this wretched disorder, when their morbid propensities drive them to such acts as these. I mention them because you must expect to meet with such cases; and because while you take care not to express your suspicions prematurely, or on light evidence, you should be upon your guard against the mortification of being deceived, by the false signals held out, into active and ill-directed measures of treatment.

There is another very common hysterical *pain* which I ought to have mentioned, viz., a pain occupying some one point in the head; the patient speaks of it as a sensation like that which would be caused by driving a nail into the part; and the affection has therefore been called the *clavus hystericus*. It is often situated just above one eye-brow; and it sometimes comes on every day, at the same hour. Now in these cases it imitates very closely the hemicrania, which constitutes no uncommon form of an intermittent, and is called, accordingly, the *brow ague*. The distinction between the two—whether the affection, I mean, be hysterical or aguish—is not of any great consequence: but in many of the foregoing examples of hysterical pain mimicking organic or inflammatory disease, the diagnosis is obviously of the greatest moment.

How, then, is it to be made? You may, generally, I believe, be led to a right judgment if you look to the several points that I have incidentally touched already. You may guess that the affection is hysterical if the patient be a young unmarried woman; if there be any disorder or irregularity in the uterine functions; if you can gather any history of former hysterical disease; and especially if she be subject to *fits* of hysteria. The suspicious symptoms may often be traced back, and found to spread themselves over a considerable previous period of time; yet there is no such wasting, or commensurate deterioration of the general health and strength, as might be expected in organic disease. When the complaint simulated is some acute local inflammation, and there is pain which seems increased upon your pressing the part, you will find that the pain is aggravated by the gentlest touch; it is more felt if you brush your hand over the surface, or slightly pinch up the integuments, than when firm pressure is made: and you will find also that this exquisite tenderness is not limited to the part complained of. Suppose it to be the abdomen, the patient will shrink and exclaim if you suddenly put your finger on her neck, or her arm. Again, wherever this tenderness may be evinced, if steady pressure be kept up while the patient's attention is diverted to some other part, or to some other topic, she will cease to complain of the pressure. The suspicion that the disorder is nervous or hysterical will also be corroborated if the symptoms which resemble the symptoms of inflammation arise and subside rapidly, without obvious cause for such fluctuation; and if various organs appear to be attacked in succession. Between the several symptoms that mark real disease there is always (as we learn by experience) a certain congruity and relation; but in the simulative displays of hysteria the symptoms are apt to be irregular, inconsistent, contradictory. When, after the most careful investigation of the case, you still doubt, it will be right either to pause, or to treat it upon the most *un*favourable supposition. The consequences of suffering active inflammation to go on unchecked would be far worse than the temporary and slight and remediable injury to the system, which might result from once applying the remedies of inflammation to a case of mere hysteria. There is another hazard also which you must be aware of, and seek to avoid; that of overlooking real disease, when it is mixed with, and masked by, hysterical symptoms. It is not easy to lay down positive rules of action for all these supposable cases; but I trust that I have said enough to convince you of the importance of making the diagnosis of hysteric complaints a careful object of your future study.

I have hitherto spoken of hysteria as if it were exclusively a malady of females. Etymologically, to apply that term to the diseases of males would be absurd. But that peculiar modification of the nervous system which is observed in hysteric girls does certainly present itself, though rarely, in young men. I have seen two or three instances of what I could give no other name to than hysteria, in males. One of them was in the person of a young surgeon who had been house-surgeon to the Middlesex Hospital. I believe he applied to not less than a dozen medical men for advice: and in that batch I happened to have my turn. He had some of the symptoms that are ascribed to hypochondriasis; *i. e.*, he was exceedingly attentive to his own sensations, and fancied that he laboured under a number of diseases which had no existence but in his own imagination: he showed great unsteadiness and infirmity of purpose; was what is called 'very nervous;' and had occasional bursts of choking, and tears, and laughter, exactly resembling those which we so often witness in the other sex. Many cases of hysteria in the male have been recorded by different writers. The same moveable state of the nervous system, and the same symptoms referrible to that system, may exist in both sexes. In females, in nine cases out of ten, or in a much larger proportion, the exciting cause of the hysteria is connected with the sexual functions; and that is all that can be meant when it is asserted that, for the female, the complaint is not badly named, but has an intimate dependence upon the uterine sympathies. At the same time it is quite true that the 'uterus is not the only organ of which the irritation may so affect the nervous system as to produce hysteria.' Mental emotion is a cause of hysteria in both sexes.

As in epilepsy, so also in hysteria, the *treatment* to be adopted regards, first, the paroxysm itself; secondly, the condition of the patient during the absence of the paroxysm.

One object, during the paroxysm, is to prevent the patient from injuring herself, by her hands, or by her teeth, or in her convulsive movements. Her dress should be loosened; but it may be necessary to confine her hands and arms. The next thing to be aimed at, is the putting an end to the fit. Various measures are found more or less useful for that purpose. The patient should be surrounded, as far as that is possible, with cool fresh air. If she be able to swallow, you may sometimes shorten the attack by administering a couple of ounces of the mistura asafœtidæ; or half a drachm of æther, with fifteen or twenty minims of laudanum, in camphor julep; or a draught containing a drachm of the ammoniated tincture of valerian. When the patient cannot or will not swallow, she may sometimes be brought about by volatile stimulating substances offered to the nostrils. Signal good may also be effected by fœtid or stimulant enemata: the enema asafœtidæ, for example, made by mixing two drachms of asafœtida, with half a pint of water, by means of the yolk of an egg; or the turpentine injection, made in the same manner, and containing half an ounce of turpentine; or the same quantity of ice-cold water thrown into the rectum, or applied to the pudenda, will often bring the fit to a speedy termination. Indeed I believe there is more virtue in cold water, in hysterical diseases, than in any other single remedy. In the paroxysm it may be freely and repeatedly sprinkled, or dashed with some force, upon the face and chest. Active purges are beneficial and requisite in almost all these cases. There is commonly a costive, sometimes an obstinate, and always an unnatural, state of the bowels.

In those long paroxysms—if they may be so called—in which some other disease is simulated by hysteria, the cold affusion is a most valuable resource: especially in those forms of the disorder in which a limb is permanently bent, or incapable of motion. In several instances, in which such contraction had existed for a long time, it has yielded in the Middlesex Hospital, to a few minutes' application of the cold douche. Dr. Corfe, as I stated before, takes much pains with these cases. He pours cold water from a tea-kettle, or any other convenient vessel, in a small stream, from a moderate height, upon the contracted limb. It has been bent up for weeks perhaps; no power that you are able to exert can extend it; and any *very forcible* attempts to straighten it give the patient extreme pain. After the stream of water has been kept up for a short time, the patient complains of it very much; but Dr. Corfe is inflexible—more so than the culprit limb—he goes on. Presently the limb begins to tremble, the tight state of the muscles is evidently on the point of yielding, and in no long time they are entirely relaxed and manageable, and the member becomes as lithe and moveable as ever. It often happens that the state of contraction recurs; but a repetition of the douche has always the same good effect, and by degrees the habit is broken, and the patient set free. It requires some determination to put this expedient in practice. The patient looks upon you as a monster of cruelty: and, in private, the friends will not always allow such 'rough' treatment, as they consider it. Sir Charles Clarke, who necessarily saw a great number of these cases—they are more common in the upper than in the lower classes of society—is a great advocate of this ducking system. A paper of his upon the subject was read before the College of Physicians a few years ago. He recommends a 'sudden and lavish' application of water to the face; or the immersion of the whole body. He describes the class of patients, in whom the hysterical affection which is curable by that method occurs, as being generally females of a pasty complexion, fat, pale, and weak; or such as present the ordinary signs of debility, a feeble pulse, cold extremities, and purpleness of parts distant from the centre of circulation. The age of the patients varied from ten to thirty years; in many of them menstruation was imperfect, or absent.

A medical practitioner whom I met lately at a patient's house, told me he had just come from another patient, upon whom he had seen a surprising cure performed. A young lady, for many days, had been affected with trismus. She was unable to open her jaws, and therefore could neither speak nor eat. At last Sir C. Clarke was called in to see her. He presently comprehended the nature of her ailment, had her placed with her head hanging over a tub by the side of the bed; and proceeded to pour pitchers of water on her face. Before he had emptied the second, the patient began to scream and scold, giving very audible indications that she could open her mouth. I say although these patients get great relief by the treatment, they do not like it; and if they are convinced that it will be put in force, they will generally contrive not to require it.

Of all the spasmodic affections, hysteria is that which is most readily propagable by what may be called moral contagion. When, in a large ward, one girl goes off in a fit, half a dozen others perhaps, all who chance to possess the hysteric diathesis, will experience a strong inclination to follow her example. But this chorus, as it were, of hysteria, is much more common in some wards than in others. A stern nurse, or a general order that the cold affusion shall at once be employed in every instance of a hysterical fit, will keep the complaint wonderfully in check: while on the other hand, any manifestation of sympathy has a striking effect in encouraging the paroxysms. These facts show that the symptoms are, to a certain degree, under the patient's control. The fits are not wholly wilful; neither are they wholly irrepressible.

Recovery from the perverser shapes of hysterical disorder is often hindered by the natural mistake to which I have just alluded. The assiduous tenderness of domestic friends serves only to keep up and quicken that absorbing self-idolatry, that craving for attention and interest, which is so constant and striking a feature of the malady. You will have frequent occasion to remonstrate—and you will too often remonstrate with incredulous hearers—against this misplaced and mischievous exhibition of sympathy. On the other hand, the patient may be helped out of her exacting and selfish humour, by an assumed but friendly indifference of manner in those about her; by what she will call cruel neglect. Or sometimes, it may be, the morbid spell may be broken by the distasteful, but wholesome discipline of some sharp stroke of adversity.

Behind the moody, reserved, and tricky behaviour which I have described, there often lies some moral or emotional cause —some hope deferred or disappointed—which being ascertained, and capable of satisfaction, and satisfied, the patient may be restored to her customary health.

It must be confessed, too, that the bounds between some forms of hysterical disorder, and some forms of decided insanity, are divided by very thin partitions.

I have but little to say respecting the *medical* management of such patients in the intervals between the paroxysms. The objects to be aimed at are, to restore the nervous system to the requisite degree of stability: and to correct the disordered functions of the uterine system. Now much the same plan of treatment is applicable to both these objects; and I spoke of the remedies that are found most beneficial for giving tone and firmness to the system, when I was upon the subject of epilepsy, and other nervous spasmodic ailments. The following points must be kept in view. The regulation of the bowels, which are mostly sluggish, by aloetic aperients; the exhibition of some form or other of steel; the steady employment of the shower bath; regulated exercise in the open air both on foot and on horseback; the avoidance of hot rooms and of late hours, both in respect of going to bed, and of rising from it;

the avoidance also of strong moral emotions, of novel-reading, and of all the other thousand modes of dissipation, mental and bodily, which always accompany, and abate the blessings of, a high state of civilisation. Marriage often proves a cure: sometimes it does not.

The disposition to hysterical disorder may be more easily prevented than cured; but upon this point medical men are not consulted. Parents do not foresee the misery they are often laying up for their daughters by the unnatural mode of life to which they are subjected, for the sake of filling them with fashionable accomplishments. I cannot close this subject, and this lecture, better than by quoting Sir Benjamin Brodie's remarks on the same point, as I find them in a little work recently published by him, and containing many highly valuable observations and instructions in respect of *local hysterical affections*.

'You can render (he says) no more essential service to the more affluent classes of society, than by availing yourselves of every opportunity of explaining to those among them who are parents, how much the ordinary system of education tends to engender the disposition to these diseases among their female children. If you would go further, so as to make them understand in what their error consists, what they ought to do, and what they ought to leave undone, you need only point out the difference between the plans usually pursued in the bringing up of the two sexes. The boys are sent at an early age to school, where a large portion of their time is passed in taking exercise in the open air; while their sisters are confined to heated rooms, taking little exercise out of doors, and often none at all, except in a carriage. Then, for the most part, the latter spend much more of their time in actual study than the former. The mind is over-educated at the expense of the physical structure: and, after all with little advantage to the mind itself: for who can doubt that the principal object of this part of education ought to be, not so much to fill the mind with knowledge, as to train it to a right exercise of its intellectual and moral faculties; or that, other things being the same, this is more easily accomplished in those whose animal functions are preserved in a healthy state, than it is in others?'

LECTURE XXXIV.

Catalepsy. Ecstasy. Mesmerism. Neuralgia: Tic-douloureux; Sciatica; Hemicrania.

There are yet some strange forms of nervous disorder which require to be *mentioned*; but upon which I do not intend to *dwell*. *Catalepsy* is one of these; and what is called *ecstasy* another. These affections are very *rare* as well as very *wonderful*: so wonderful and rare, that weak and superstitious persons have referred them to the interposition of supernatural agents in human affairs; and stronger-minded persons, who happen never to have witnessed such diseases, deny their occurrence as fabulous, or laugh at them as the tricks and cheatings of imposture. They certainly do happen, however; and they happen mostly in the same class of persons in whom hysterical and nervous complaints of all kinds are most common. They often appear to be produced by similar causes with these: they resemble hysteria in being seldom attended with any danger to life: their pathology is, if possible, still more obscure than that of hysteria: and if I were to speak of the treatment which would seem to be most suitable for their cure or prevention, I should merely have to repeat what I said, upon the treatment and prevention of hysteria, in yesterday's lecture. I shall content myself, therefore, with a short description of these two affections, that you may be aware of their characteristic phenomena, and not be taken by surprise in case either of them should occur to you in your practice.

A fit of catalepsy implies a sudden suspension of thought, of sensibility, and of voluntary motion; the patient remaining, during the paroxysm, in the position in which she (for it is almost always a female) happened to be at the instant of the attack, or in the position in which she may be placed during its continuance; and all this without any notable affection of the functions of organic life.

This is certainly a very curious state, and one different from any that we have yet contemplated. We have had the muscles rigidly contracted with tonic spasm, while the powers of the mind, and the sensibility of the body, were unimpaired. We have had the same muscles shaken with clonic convulsions;

both with and without coexistent disorder of the intellectual functions. But here we have a new phenomenon: the mental faculties are in abeyance, and the sensibility is abolished, and so also is the function of voluntary motion; but the limbs are not tied down by spasm; nor agitated by successive contraction and relaxation of their muscles; nor yet left, like portions of dead matter, passively obedient to the laws of gravity: they assume any posture in which they may be placed, and that posture, however absurd, however (to all appearance) inconvenient and fatiguing, they retain, until some new force from without is applied to them, or until the paroxysm is at an end. The patient so affected, with open staring eyes often, and outstretched limbs, looks like a waxen figure; or an inanimate statue; or a frozen corpse. Indeed, Hoffman seems to have formed the strange conclusion that, as catalepsy, so far as he knew, occurred most frequently in winter, it must depend on congelation of the nervous fluid.

These singular attacks occur in paroxysms; and they have been known to alternate with well-marked hysteria; and to take place in connection with insanity. I have never seen an instance of perfect catalepsy, which I now regret, as I once had an opportunity of doing so, of which I did not avail myself. Dr. Gooch has described a case of it, as he witnessed the disease in a patient who suffered puerperal mania. She had long been subject to the common forms of hysteria. This is illustrative of what I have often stated respecting the consanguinity of these nervous disorders. It had become necessary to confine this patient in a strait-waistcoat; she was attended by Dr. Gooch and Dr. Sutherland. I will quote Dr. Gooch's account of the cataleptic state, for it is authentic and modern. He says, 'A few days after our first visit we were summoned to observe a remarkable change in her symptoms: the attendants said she was dying or in a trance. She was lying in bed, motionless, and apparently senseless. It had been said that the pupils were dilated, and motionless, and some apprehensions of effusion on the brain had been entertained: but on coming to examine them closely, it was found that they readily contracted when the light fell upon them; her eyes were open, but no rising of the chest, no movements of the nostrils, no appearance of respiration could be seen; the only signs of life were her warmth and pulse; the latter was, as we had hitherto observed it, weak, and about 120.

'The trunk of the body was now lifted, so as to form rather an obtuse angle with the limbs (a most uncomfortable posture); and there left with nothing to support it; there she continued sitting while we were asking questions and conversing; so that many minutes must have passed. One arm was now raised, then the other; and where they were left, there they remained. It was now a curious sight to see her, sitting up in bed, her eyes open, staring lifelessly, her arms outstretched, yet without any visible sign of animation. She was very thin and pallid, and looked like a corpse that had been propped up, and had stiffened in this attitude. We now took her out of bed, placed her upright, and endeavoured to rouse her by calling loudly in her ears; but in vain. She stood up, but as inanimate as a statue. The slightest push put her off her balance. No exertion was made to regain it. She would have fallen if I had not caught her.

'She went into this state three several times. The first time it lasted fourteen hours, the second time twelve hours, and the third time nine hours; with waking intervals of two days after the first fit, and one day after the second. After this the disease resumed the ordinary form of melancholia; and three months from the time of her delivery she was well enough to resume her domestic duties.'

There is a minor form of this affection described, in which the patient is incapable of moving or speaking, but is conscious of all that goes on around him at the time. I saw a lady last year, who was subject to these attacks of imperfect catalepsy: which have also been called whimsically, but expressively, attacks of *day-mare*. From her time of life, her habits, and some other points in the history of the disease, I concluded that in her case these seizures, of temporary loss of muscular power without loss of consciousness, were dependent upon a diseased state of the blood-vessels of the brain. She afterwards consulted Dr. Chambers; and he told me that he had formed the same opinion of the nature and cause of the symptoms.

In what is called *ecstasy*, the state is different. The patient is lost to all external impressions; but wrapt and absorbed in some object of the imagination. The muscles are sometimes relaxed; sometimes rigid as in slight tetanus: but the loss of voluntary power over them is not complete or universal, for these patients often speak in a very earnest manner, or sing. They are, as the term εκστασις imports, out of the body at the time, wholly engrossed in some high contemplation. This state is not uncommon as forming a part of religious insanity; and sometimes it runs into ordinary hysteria. Nervous and susceptible persons are apt to be thrown into these trances under the influence, whatever it be, of mesmerism: and grave authors assure us that the intelligence which then deserts the brain, concentrates itself in the epigastrium; or at the tips of the fingers: that people in that state read letters which are placed upon their stomachs, or applied to the soles of their feet; answer, oracularly, enigmatical questions; discover and declare their own and other persons' internal organic diseases; describe minutely and accurately distant scenes which they have never visited, nor previously heard of; and even foretell future events. Credat Judæus Apella, non ego. I take for granted that they who were in the habit of speaking, a few years since, in some of our places of worship, in what they called *unknown tongues*, were either gross impostors, who deserved to be publicly whipped, or persons labouring under this disease, and wanting physic. Dr. Copland mentions a curious fact in connection with this subject. He says that many of the Italian Improvisatori are in possession of their peculiar faculty only while they are in a state of ecstatic trance; and that few of them enjoy good health, or consider their gift as otherwise than something morbid.

Do not suppose, from what I have just said, that I ignore the glaring *facts* of mesmerism. I have seen and scrutinised too many of them to doubt their genuineness, or to ascribe them to mere imposture or collusion. You may desire to know, and you have a right to know, my creed upon this vexed and much-abused subject. It is this. Of the brain and nerves there are many and various strange conditions, which we reckon as manifestations of disease or disorder. They occur, as it would seem, spontaneously; or during the progress of some better known malady. I have given you several wonderful examples of such unnatural and morbid states under the heads of hysteria, chorea, catalepsy, ecstasy, trance. I might have described to you the curious condition, or alternating conditions, of *double-consciousness*; and the familiar phenomenon of *sleep-walking*. Now, whatever condition of this kind may arise thus spontaneously, may also, I believe, be produced, in some persons, under the mesmeric practisings. Not however through any material or occult influence emanating from the mesmeriser; but subjectively, from the mental attitude (if I may use that expression) in which the person mesmerised is led to place himself. There are many simpler forms of unconscious mesmerism, which we witness every day, without regarding or recognising them: the propagation of a yawn for example; the irresistible slumber under the drone of a dull preacher. Into these moods or postures of the mind, into this discord of the nervous functions, this disturbance of their natural harmony or equilibrium, the mesmeriser may beguile his victim: but the experiments of Mr. Braid show clearly that the agency of the mesmerist is not essential to the manifested effect. Any one, having the requisite susceptibility, may put himself into the mesmeric sleep or the mesmeric trance, by fixing his eyes and his attention steadily and unremittingly upon an object made to project a little way from the centre of his own forehead. The phenomena are subjective phenomena. The determining influence is from within as much as, or even more than, from without. Derangements such as sometimes occur thus in disease, may also sometimes occur under the mesmeric atmosphere: but no other or more mysterious derangements. Thus much I perfectly believe. I believe too that sleep may sometimes be conciliated by the monotonous biddings of mesmerism, when drugs might fail to procure it: and that such sleep may become sometimes, and in certain diseases, a mode and an instrument of cure. But I go no further. All the transcendental phenomena—the miraculous diagnoses and revelations, the clairvoyance, the prophecies—I class with the spirit-rappings and the table-turnings, as evidences of imposture on the one side and of miserable credulity on the other, and as alike scandalous in an age and country which vaunt themselves to be enlightened.

Leaving these nervous disorders, in which the function of voluntary motion is so curiously modified; and in which there sometimes is no alteration of the intellectual faculties, and sometimes very great disturbance, or the complete suspension of them; I would now turn your attention to another class of complaints, in which the nervous system is still the part principally interested, but in which the deviation from the natural state is manifested chiefly in the function of *sensation*: the powers of thought and of voluntary motion being scarcely affected, or not affected at all. Complaints, I mean, in which the sensibility is perverted, and augmented; cases of nervous *pain*. We have considered before that modification of sensation which consists in numbness, or anæsthesia, *i. e.* in the diminution of the natural sensibility, or its total privation. We have noticed also incidentally many perversions of sensation;

such as giddiness, nausea, faintness, and the like; and in the same incidental way the morbid *exaltation* of the sensibility which is called *pain*, has come before us, as a symptom in various other diseases; in inflammation, and in hysteria. But there are diseases which consist of pain, and of nothing else, that we can perceive. They are often attended by no inflammation, no detectable change of structure in the painful part, no fever. These affections are included under the general term, *neuralgia*. Now pain is one of the things which we are oftenest consulted about; and these neuralgic pains are apt to be excessively severe and troublesome; and it cannot but be of importance to understand what has been ascertained of their nature, and causes, and capability of cure.

That pain is owing to some morbid condition or to some irritation of a particular nerve, we may sometimes know, by finding that it is felt exactly in the course, and follows the distribution, of that nerve. But when, as often happens, the pain is confined to a certain spot, we then conclude it to be neuralgic, if and because we can find no other explanation of its existence.

What increases the difficulty of making out the cause and origin of these nervous pains, is that they may be produced by some source of irritation operating at a distance from the part in which the pain is felt. It may be placed in the brain itself, or in the spinal cord; or in the trunk of the nerve that supplies the affected part; or in one of the branches of the same trunk, which branch is distributed to another part. If you strike the inside of the elbow in a certain way, so that the blow lights upon the ulnar nerve, a peculiar tingling sensation is felt in the little finger: that is, *not* in the part struck, but in the sentient extremity of the stricken nerve; and the same thing happens continually in disease. There is an excellent paper on this subject, by Sir Benjamin Brodie, published in one of the earlier volumes of the 'Medical Gazette,' in which he has collected numerous and striking illustrations of the production of nervous pain by irritation situated in a distant part. Thus, to take a case in point; a man was admitted into St. George's Hospital on account of severe pain on the inner side of his knee. The joint was carefully examined, but no mark of disease could be detected in it. On tracing the limb upwards, however, an aneurism of the femoral artery, as big as an orange, was discovered in the thigh. This the patient thought nothing of; his only concern was the pain in his knee. Sir E. Home performed the usual operation for aneurism: and the moment the ligature was drawn firmly round the artery in the upper part of the thigh, the tumour ceased to pulsate, and the pain in the knee ceased also. This man died four or five days after the operation; and upon inspection of the limb after his death, the aneurism was found reduced to one-half its former size; and some branches of the anterior crural nerve, which passed over it, and which must have been kept on the stretch previously to the operation, were seen to terminate in the part to which the pain had been referred on the inside of the knee. There is just such another case related by Dr. Denmark, in the 'Medico-Chirurgical Transactions.' A sailor was wounded by a musket-ball in the arm. The wound healed; but the patient remained affected with agonising pain, beginning in the tips of the thumb and fingers, except the little finger, and extending up the fore-arm. His sufferings were so great that he willingly submitted to have the limb amputated: and the operation gave him complete and immediate relief. When the severed limb was dissected, a small portion of lead, which doubtless had been detached from the ball when it struck against the bone, was found imbedded in the fibres of the median nerve.

These examples teach us, when we receive complaints of pain in any part, and can discover no cause of pain in the part itself, to look for some possible source of irritation in the trunk of the nerve, from which the part in question is supplied with nervous fibrils.

But the source of irritation may be further back than this: it may depend upon a diseased state of the spinal marrow, or of the brain. Of this, having had so many examples before us already, I need not seek for any new illustrations.

Sometimes, again, irritation applied in the course, or at the extremity of *one* branch of a nerve, will give rise to pain at the extremity of *another* branch of the same nerve. The sensation appears to be reflected, as it were, along the branch which is not directly the subject of the irritation. Thus filaments of the phrenic nerve penetrate the diaphragm and communicate with the ganglia that lie around the cœliac artery; other filaments are distributed to some of the muscles about the shoulder; and in this way has been explained the well-known fact, that disease or irritation of the liver is very apt to be accompanied with pain in the shoulder.

Thus also we have pain in the glans penis, from irritation of the bladder, produced by a stone there: pain in the thigh and testicle, from irritation of the kidney, or of the ureter: pain in the left arm, from disease of the heart: pain in the feet, from stricture and irritation of the urethra.

There are many pains also, plainly enough connected with irritation of distant parts, although no other nervous connection can be traced between the parts, except that which is afforded by the nervous centres. In such cases we must suppose that the morbid impression travels to the brain, and then the sensation is referred to the painful part through another nervous channel of communication. Dr. Wollaston was accustomed to relate the following story of himself. He had eaten some ice-cream after dinner one day; and his stomach did not seem to be capable of digesting it. Some time afterwards, when he had left the dinner table for the drawing room, he found himself rendered lame by a violent pain in one ankle. Suddenly he became sick, the ice-cream was vomited, and instantaneous relief of the pain followed its ejection from the stomach. 'A gentleman (says Sir Benjamin Brodie) awoke in the middle of the night, labouring under a severe pain in one foot. At the same time certain other sensations, to which he was not unaccustomed, indicated the existence of an unusual quantity of acid in the stomach. To relieve the latter he swallowed a large dose of alkaline medicine. Immediately on the acid in the stomach having thus been neutralised, the pain in the foot left him.'

The lesson that we learn from all these facts is this: that when we can find no explanation of a pain in the very spot in which it is felt, we should look for some condition that may explain it, in the trunk of the nerve supplying that part; or in the parts supplied by other branches of the same nerve; or (if still we are unsuccessful), we seek for other indications of disease in the brain or spinal marrow: and if these be wanting, we should extend our search, and enquire whether there be any intelligible disorder or cause of irritation elsewhere, which, operating through the medium of the nervous centres, may have occasioned the sympathetic pain of which our patient complains.

I say we should institute this quest, because, if it be successful, it may teach us, on the one hand, that the cause of the pain is fixed and irremediable; or, on the other, it may enable us by some simple and obvious expedient to cure the pain. But sometimes we shall be quite disappointed in all this seeking. We shall find nothing, either in the living patient, or in the dead body, which throws the smallest light upon the cause of the neuralgia.

Now with respect to those neuralgic pains, for which we can discover no adequate cause, either in any diseased structure, or in any morbid action or condition of the blood-vessels, there are certain general facts observable which I will mention before I specify any particular forms of neuralgia. They occur in all parts of the body; but they are more frequent about the head than in any other part; and next of all, probably, in the abdomen. In the head, or face, the branches of the fifth pair of nerves are very frequently the seat of neuralgia; and to such pain, in that situation, the name of *tic douloureux* is generally given. The painful affection called *hemicrania* is another example of neuralgia in the head. Certain forms of *angina pectoris*, and of *gastrodynia*, seem to belong to the same class of disorders: and *sciatica*—which depends on different causes in different cases—is often rather a neuralgic than a rheumatic pain. I have stated that the pains sometimes follow the track of certain nerves; but this is not, I think, very common. Inflammation of the nerve, or of its investments, generally causes pain having that property; but the truly nervous pains are much better characterised by the suddenness with which they come on, and the suddenness with which they sometimes go off also; by their intermittence in many cases, and the regularity of the period at which they often, though not always, return; by the total absence (in most cases) of heat and swelling, and often of tenderness too, when they are external, and of febrile symptoms when they are internal, even although their intensity be extreme; by their apparent dependence, in numerous instances, upon sudden changes of the weather; by their occurring chiefly in persons of a nervous temperament in whom the health is otherwise disordered; and by their frequently abating under tonic remedies, or what are called specifics, rather than under antiphlogistic treatment. (ALISON'S 'Outlines.') There is another circumstance, characteristic of these pains, which has been mentioned by Sir Benjamin Brodie, and I do not know that the same thing has been noticed by other writers. These pains are often suspended by sleep. 'A person suffering from tic douloureux in the face may for a time be prevented from falling asleep, but if once asleep, his sleep is likely to be sound and uninterrupted for many hours.' He says that though there may be exceptions to this rule, they are comparatively rare. Now this, you will observe, is quite analogous to what takes place also in certain spasmodic affections of the muscles. The jactitations of chorea are almost always suspended during sleep. It is the same with the spasmodic wry neck, in which the involuntary contraction of some muscle, commonly the sterno-cleido-mastoideus, drags the chin round, and the head awry. Persons affected with that sort of deformity when awake, have their necks flexible enough, I believe, while they are sleeping.

I mentioned just now one character of these neuralgic pains, viz., the total absence in most cases, when they occupy the surface, of heat, redness, swelling, or tenderness; and I said *in most cases*, because there are unquestionably exceptions to this. After these pains have been long-continued and intense, they may give rise even to a moderate degree of inflammation of the part; which may become tender to the touch, manifestly vascular, and even swollen a little. 'In a gentleman,' mentioned by Sir B. Brodie, 'who suffered for a great length of time what was regarded as a most severe tic douloureux in the face, at first the parts to which the pain was referred retained their natural appearance, but ultimately they became swollen, from an effusion of serum into the cellular texture, and so exquisitely tender that they could not bear the slightest touch. In a patient who had laboured for some time under pain in the testicle, depending on a calculus passing down the ureter into the bladder, the testicle became tender and considerably swelled.'

The attacks of neuralgia may recur at intervals of a few seconds only; or they may take place daily, or every other day; or they may be separated by much longer intervals, regular or irregular. Sometimes there is continual pain, but it is wonderfully exalted and aggravated by fits. It is described as being sharp, sudden, twingeing, like an electric shock in its momentary duration. Sometimes it is attended by a feeling of constriction and cramp, although no muscular contraction accompanies it. I suppose that is one reason why such pain is so often spoken of even by medical men, and almost always by the vulgar, as *spasm*. Whenever a patient tells me he has spasms here or there, I am obliged to request that he will explain himself further. I want to know how he construes spasm; and nine times out of ten I find that he intends a sudden and sharpish, and generally a transitory attack of *pain*: whereas the term spasm really signifies, and ought to be restricted to, involuntary muscular contractions. When a medical man prints a case in which he states that spasms occurred in such or such a part, it is impossible to tell what he means, unless that term is explained by the context. Pray avoid this inexactness.

The most common of these neuralgic pains, as I have said, is that which has been called κατ' εξοχην, *tic douloureux*, and which is situated in the facial branches of the fifth pair of nerves; nerves, as you know, of sensation; and it is usually restricted to one of the three branches that emerge severally to supply the parts in their neighbourhood. Sometimes two, sometimes all of them, are implicated. The middle one of these branches, the infra-orbitary, is the most commonly affected in the severer forms of the complaint. The torture occasioned by this dreadful malady is sometimes excessive. The sufferers speak of it as anguish that is scarcely endurable; and you see, in their quivering features and restless limbs, that the acute bodily pang is, indeed, hard to bear. Trousseau draws a life-like picture of one of these paroxysms. A man (he says) who but a moment ago was perfectly free from pain, is suddenly seized with horrible pain, while talking with you. He puts his hand to his face, pressing or rubbing it with considerable force: or he rocks himself to and fro, holding his head between his hands, and uttering half-suppressed groans. This scene lasts ten, fifteen seconds—one minute at the most; and then all is over. He resumes the interrupted conversation until a fresh paroxysm sets in.

When the uppermost branch of the trifacial nerve is the seat of the complaint, the pain generally shoots from the spot where the nerve issues through the superciliary hole; and it involves the parts adjacent, upon which the fibrils of the nerve are distributed; the forehead, the brow, the upper lid, sometimes the eyeball itself. The eye is usually closed during the paroxysm, and the skin of the forehead on that side corrugated. The neighbouring arteries throb, and a copious gush of tears takes place. In some instances the eye becomes blood-shotten at each attack; and when the attacks are frequently repeated, this injection of the conjunctiva may become permanent.

When the pain depends upon a morbid condition, or morbid affection, of the middle branch of the nerve, it is sometimes quite sudden in its accession, and sometimes comes on rather more gradually; being preceded by a tickling or pricking sensation of the cheek, and by twitches of the lower eyelid. These symptoms are shortly followed by pain at the infra-orbitary foramen, spreading in severe flashes (so to speak) over the cheek, affecting the lower eyelid, ala nasi, and upper lip, and often terminating abruptly at the mesial line of the face. Sometimes it extends to the teeth, the antrum, the hard and soft palate, and even to the base of the tongue, and causes spasmodic contractions of the neighbouring muscles.

When the pain is referrible to the inferior or maxillary branch of the fifth pair of nerves, it darts from the mental foramen, radiating to the lips, the alveolary processes, the teeth, the chin, and to the side of the tongue. It often stops exactly at the symphysis of the chin. Frequently it extends in the other direction to the whole cheek and to the ear. During the paroxysm the features are liable to be distorted by spasmodic action of the muscles of the face, amounting sometimes to tetanic rigidity, and holding the jaw fixed and immoveable.

The paroxysms of suffering in this frightful disease are apt to be brought on by apparently trivial causes; by a slight touch, by a current of air blowing upon the face, by a sudden jar or shake of the bed on which the patient is lying, by a knock at the door, or even by directing the patient's attention to his malady by speaking of it, and asking him questions about it. This was remarkably manifest in a patient who came into the hospital under my care for another complaint; but who had for some time been subject to tic douloureux. The necessary movements of the face in speaking, or eating, are often sufficient to provoke or renew the paroxysm. At the same time firm pressure made upon the painful part sometimes gives relief, and causes a sense of numbness to take the place of the previous agony.

This cruel malady occurs most commonly in persons who present, in other respects, the signs of an unsound, or deranged, or debilitated system. It is more apt to fasten upon those who are pale, and asthenic, and upon individuals whose powers have been broken by advancing years. It is not unfrequently attended with some obvious disorder of the digestive organs, and ceases or is mitigated when that disorder is corrected. Sometimes it is clearly connected with a disposition to rheumatic affections; coming on in persons who suffer rheumatism in other parts, and even alternating with rheumatism in other textures. It is observed to be common among fishermen, and the inhabitants of marshy districts; and in some of these sufferers it may be attributable to their habitual exposure to cold and moisture. The trifacial nerve, lying superficially, and being unprotected by any artificial covering, is more likely perhaps, for that reason, to be affected by vicissitudes of temperature; but in many of these cases the disease seems to be produced by the *malaria* which is prevalent in those situations. The paroxysms are then not only intermittent, but periodical, and they will frequently yield to the remedies which have been ascertained to be specific against ague and its various modifications. Sometimes the facial neuralgia is evidently dependent upon some general state of the system: for it will cease in the face, and fix itself in some other place; and in this way it may come to occupy several distant parts of the body in succession. There are other cases again in which the disease has a local origin, and results from some diseased bone, or exostosis, in the neighbourhood of the painful spot. The late Dr. Pemberton afforded a well-known example of this. He was seized with tic douloureux when in the very zenith of his reputation, and in the fullest exercise of his profession in this town. It completely ruined him: compelled him to give up business. He ultimately died of apoplexy. When his head was examined after death, the os frontis was found to be unusually thick, and on the falciform process of the dura mater, at a little distance from the crista galli, a small osseous substance was discovered, nearly half an inch long, and almost as broad. Sir Henry Halford has recorded several other instances in which the disease was connected with some morbid condition of the bones of the head or face: and I believe that the bones which are most often in fault are the teeth. Of tic dependent on this cause there are some remarkable examples recorded in works on dental surgery. I have myself known one instance in which agonising throes in the middle and in the lower branches of the fifth nerve on one side were arrested at once by the process of 'stopping' a hollow molar tooth on that side: that is, by preventing the access of air to the nervous element of the decayed grinder. More often the culprit tooth seems outwardly sound, but after its extraction is found to have its fangs enlarged by bony growths, or some sort of thickening.

Now tic douloureux is one of those complaints for the cure of which there exists a number of so-called specific remedies. But what I have been stating of this disease will suffice to convince you that, as it depends upon different causes in different persons, it is absurd to expect that any single drug—or even any one plan of treatment—will always remove it. Our first care, in every example of it that comes before us, must be to investigate all the particulars of that case. We must not be satisfied with learning that the complaint is tic douloureux, and then go on prescribing one after another the reputed specifics for tic douloureux. It may happen that the origin of the disease is plain, and the remedy obvious. We must endeavour to make out whatever is amiss in the system at large, or in the state of particular functions. Very rarely, I believe, tic douloureux is dependent upon a condition of general plethora. Mr. John Scott gives the case of a gentleman who suffered severely from it for some time; at length he had an attack of apoplexy, and for this last disorder he was copiously bled, and the bleeding seemed to cure the neuralgia. Much more frequently we find evidence of a feeble or a shattered state of the system; debility and paleness; and then we may expect to do good by the treatment so strongly recommended by Mr. Copland Hutchinson, viz., by giving the carbonate of iron. This remedy has been put largely to the test, since Mr. Hutchinson wrote in commendation of it, by Dr. Elliotson, and subsequently by others. Dr. Elliotson states it as the result of his experience that, 'in all cases of neuralgia, whether exquisite or not, unaccompanied by inflammation, or evident exciting cause, iron is the best remedy.' In all cases it is of the utmost consequence that the state of the digestive organs should be attended to. Mr. Abernethy used to relate, in his lectures, many instances of tic which he had succeeded in curing by measures which were directed solely to remedying some faulty state of the stomach and bowels. He had a *dictum*, that in patients who suffer under this disorder, there were always two functions wrong; those of the nervous system on the one hand, those of the digestive system on the other. And I am sure you will commonly find indications of something amiss in both these systems. 'The two,' he used to say, 'were the common parents of a numerous progeny of very dissimilar local diseases. In tic douloureux, you must seek to put the digestive organs right, or to soothe the nervous system, according as the one or the other may seem to be the principal and primary cause of the disease. Take away one of the parents, and there will be no more propagation.'

In these cases, the unhealthy state of the digestive apparatus may be marked by obvious signs: a furred tongue, loss of appetite, costive bowels: or it may reveal itself by no other symptom than the pain. It may depend upon the mere presence of acid in the stomach. Dr. Rigby tells us that having suffered in his own person an intense attack of tic douloureux, which opium did not assuage, he swallowed, at the suggestion of a friend, some carbonate of soda dissolved in water. The effect was almost immediate: carbonic acid was eructed, and the pain quickly abated. More often the cause of offence appears to lie in some part of the intestines; and purgatives do good. Sir Charles Bell—drawing a bow at a venture—achieved the cure of a patient, upon whom much previous treatment had been expended in vain, by some pills composed of cathartic extract, croton oil, and galbanum. He mixes one or two drops of the oleum tiglii, with a drachm of the compound extract of colocynth; and gives five grains of this mass, with ten grains of the compound galbanum pill, at bed-time. I mention the exact proportions and dose, because other cases have been since reported, both by Sir Charles and by others, in which the same prescription was followed by the same success.

When the disease occurs in a rheumatic individual, and especially when, as is sometimes the case, it alternates with rheumatism of other tissues, the remedies which have been found useful in rheumatism deserve a fair trial: guaiacum; colchicum; calomel and opium; iodide of potassium.

When all has been done that can be done towards restoring or improving the general health, we may turn our thoughts to local remedies. It is plain that these must be inefficient when the local pain results from constitutional causes that are unredressed, or perhaps incurable. Yet even then topical measures may soothe the pain for a while.

One of these topical expedients, which promised well when first thought of, is the division of the trunk of the painful nerve, so as to cut off the nervous communication, through that main channel at least, between the painful part and the brain. This was originally proposed by Dr. Haighton, and was at first attended with some little success; but in a great number of instances it has signally failed, as indeed might have been expected. In Dr. Pemberton's case the several branches of the fifth pair were cut by Sir Astley Cooper: but in vain. When there is any reason to think that the disease has a constitutional origin, or a local *distant* origin, the division, or even the excision, of a part of the nerve must be perfectly useless. It would be as reasonable (as Mr. Abernethy has observed) to expect to cure gout by cutting the nerve that goes to the great toe: or to perform castration with the view of remedying that pain in the testicle which is apt to be produced by the passage of a calculus through the ureter. Nevertheless there are cases, in which the division of the nerve, or some other surgical operation, is required. If you can make out that there is any tumour pressing upon or adherent to some part of the nerve—or if some foreign body, as a splinter or a shot, should be ascertained to be in contact with the surface of the nerve, or to be entangled in its substance—the tumour or the foreign body may be removed by the knife, with the strong expectation that a cure will be thus effected. And if this cannot be done, or if the nerve itself be altered in structure, either from disease or injury, (I am referring now to neuralgia in general, and not merely to that in which the facial branches of the fifth pair of nerves are implicated,) under those circumstances it will become a very proper subject of deliberation whether the nerve should be divided, or even the limb amputated.

In the 'Medical and Physical Journal' there is a case described by Mr. Jeffries, of a violent facial neuralgia, cured instantly by the removal of a small fragment of china, which had been lodging in the cheek for fourteen years. And Mr. Descot mentions an instance in which a very severe affection, of ten years' standing, was put an end to by the extraction of a carious tooth. I saw, not many days ago, a young woman whose finger had been amputated for very acute neuralgic pain which she had suffered in it; and the amputation had been successful in liberating her from that pain.

Sometimes we may hope to afford relief to the suffering patient by means which tend to remove or lessen the *exciting* cause of the paroxysms. Of this I may mention one remarkable example, which fell in part under my own observation: although I had nothing to do with the treatment. I was asked, a few years ago, by an acquaintance, to call with him upon a relation of his, who, laboured, he said, under tic douloureux: he did not wish me to see her professionally, but was desirous that I should witness what he considered an extraordinary complaint. I saw a young girl, about twelve or thirteen years old, very pale and delicate, lying on a sofa; and I learned from her and from her mother that she was subject to the most excruciating agony in one side of her face and neck. The pain came on whenever she swallowed anything: the act of deglutition proved invariably the exciting cause of the torment. She was at that time under the care of a practitioner, who had desired that she might eat mutton-chops three or four times a-day. Of course this was a sentence full of misery to her; but so desirous was she to get rid of her disease, that she resolved steadily to follow the enjoined directions. This plan was to be tried for at least a month; after that time, if she were no better, her mother had resolved to consult another practitioner who had been much recommended to her. I should say that she had already consulted a great number of medical men; for the malady had existed nearly two years. At the end of the month she was worse than at the beginning; and the new practitioner, Mr. Pennington, was called in. He acted, like a man of sense and sagacity, upon the fact that the act of swallowing always gave rise to the pain; and he advised that she should not attempt to swallow for twenty-four hours. That period passed without any return of the pain; but it immediately recurred upon her eating a morsel of bread. The result of this experiment, however, encouraged him to hope that the morbid habit might be broken through by a sufficiently long abstinence from swallowing. And as she had been subjected to a great variety of fruitless treatment, he gave her no medicine, but advised that she should refrain altogether from taking food or drink by the mouth. Nourishing injections, composed of beef tea with an egg beat up in it, or of milk, were thrown into the rectum, two or three times a-day. This plan was persisted in for a longer time than I should have supposed she could have endured it. No nutriment whatever was taken by the mouth for five weeks and three days, and no paroxysm of pain occurred. At the end of that period the pulse sank suddenly, from between seventy and eighty, to thirty-five beats in a minute; and thereupon Mr. Pennington, thinking he had carried his experiment far enough, deemed it advisable to administer by the mouth a dessert-spoonful of beef-tea twice a-day. This was continued for four days without producing any return of the pain. A small piece of fish was then allowed, and afterwards some chicken; and proceeding thus cautiously, in the course of a month she was able to eat and drink anything, without the slightest inconvenience.

I should state, however, that some time afterwards, the neuralgia returned in another situation, affecting the left knee: and this was remedied by a different mode of treatment. She is since dead.

Dr. James Arnott bears strong testimony to the power of *violent body exercise*, as a prompt and very agreeable remedy in certain neuralgic (and rheumatic) affections. He is enabled to speak from experience of its value in his own person, as well as in other instances. Having at one period of his life been tortured for six months by a neuralgic pain in his face, he resorted, upon a subsequent return of the pain, to the remedy just mentioned; and he succeeded on *every* occasion of its accession, whether by night or by day, in putting a stop to the pain by exercise with heavy dumb-bells, and particularly by retaining them as long as he could with outstretched arms, in a horizontal position. Two or three minutes, he says, of such exercise will generally be enough; but the amount of it requisite will probably be proportionate to the degree of the morbid affection.

When other means fail, or in conjunction with other means, local applications to the affected part may and should be tried. Belladonna will sometimes materially palliate the pain; so will opium. Not many years ago a new anodyne was brought into use; and has been found of essential service in several instances of this most painful disorder. I allude to *aconitine*: the active principle of the monkshood. The property belonging to this plant, of benumbing sensation, has long been known. Sir Benjamin Brodie found, many years ago, that after chewing its leaves, a remarkable numbness of the lips was left, which lasted some hours. We may understand therefore the beneficial operation of the aconitine upon a part of which the sensibility is unduly exalted. Aconitine is a strong poison; and its use demands proportionate care and precaution. The *Unguentum Aconitiæ* of the British Pharmacopœia furnishes a safe mode for its external application. A small portion of this ointment may be smeared over the track of the painful nerve once or twice a day. A sense of numbness is thus produced which continues for many hours. It seems probable that the recurrence of the pain is sometimes kept up by the influence of habit; and will cease if the habit can for a while be broken. After all, the subcutaneous injection of morphia is the remedy upon which most reliance may be placed for the immediate relief of neuralgic suffering. It proffers present ease under the torturing paroxysms of this terrible malady in most cases; permanent ease when their recurrence depends, mainly or altogether, upon the force of habit. We must not expect that this or any other anæsthetic agent will effect a cure if the pain result from some abiding cause of local irritation, or from some unredressed fault in the constitution at large. But in the worst instances it may shorten the periods of suffering, and give scope for the operation of measures more strictly sanative.

There is a kind of face-*ache* which cannot properly be reckoned as a species of neuralgia, for it does not occur in short stabbing paroxysms, nor is the pain acute enough to entitle it to the name of tic douloureux; but which is very common, very distressing, and under ordinary treatment sometimes very intractable. It is called by some a rheumatic pain; it occupies the lower part of the face, the jaw principally, and the patient cannot tell you exactly whereabouts it is most intense. It is often thought to proceed from toothache, and bad or suspected teeth are extracted, but with no good effect. Now I allude to this for the sake of saying that some years ago I was instructed by an experienced old apothecary, that this face-ache might be almost always and speedily cured by the chloride of ammonium—salammoniac;—a medicine that we seldom give internally here, although it is so much used in Germany. And I have again and again availed myself of this hint, and been much thanked by my patients for the good I did them with this salt of ammonia. It does not *always* succeed; but it *often* does. It should be given in half-drachm doses, dissolved in water, or in almost any vehicle, three or four times a-day. If the pain do not yield after four doses, you may cease to expect any benefit from it. In two or three instances of a similar kind that I have recently had to treat, I have found the iodide of potassium, in doses of five or six grains, work a speedy and permanent cure. This leads me to suppose that the pain in some of these cases may be periosteal. I so judge from the ascertained efficacy of the iodide in other periosteal affections attended with pain.

Tic douloureux is the principal form of severe neuralgia which you may expect to meet with, in regard to acuteness of suffering and difficulty of cure. Two other forms, more common, and luckily more tractable, are generally spoken of under the same head; *sciatica*, namely, and *hemicrania*. I have very little to say, in this place, of either of these. Sciatica, or pain radiating from the sciatic notch, and following the course of the sciatic nerve, is sometimes an inflammatory complaint, and yields to the remedies of inflammation—cupping and blistering: sometimes it is plainly a part of rheumatism; and then may often be relieved by calomel and opium, or by colchicum: sometimes, again, it results from irritation within the pelvis, affecting the nerve before it emerges externally; this irritation may be connected with a disordered state of the kidney, and I suspect that it is in such cases that the oil of turpentine is of so much use: lastly, it is sometimes a purely nervous and neuralgic pain: and then the treatment applicable to facial neuralgia will, *mutatis mutandis*, be applicable to it. I had, some time ago, a butler under my care at the hospital, whom I am afraid I did not manage cleverly. He suffered severe sciatica, and I had him cupped and blistered, and gave him a variety of medicines, for some time to little purpose: at last he got what I ought, I suppose, to have given him at first, viz. the carbonate of iron, and was presently well.

In a complaint so painful, so crippling, and oftentimes so obstinate, it is well to be provided with a succession of accredited remedies. One physician of my acquaintance assured me some time ago that he cured all his cases of sciatica by putting a blister as large as half-a-crown over the spot where the nerve emerges, and sprinkling the surface exposed by the removal of the cuticle with half a grain or a grain of morphia in powder; but this was before subcutaneous injections came into vogue. Sulphur, again, has long been a popular remedy for rheumatism; and Dr. Fuller expresses his belief that in cases of rheumatic sciatica, unattended with fever, there is no external application so serviceable. The affected limb is swathed in flannel which has been thickly sprinkled with precipitated sulphur: over the flannel is placed a covering of oiled silk, or of thin gutta-percha; and the flannel bandages are kept thus applied night and day.

Hemicrania is simply headache, confined to one side, and occupying generally the brow and forehead, but sometimes affecting very exactly one moiety of the head. It is the *migraine* of the French, the *megrim* of our vernacular language; each of these terms being obviously traceable to the same Greek root. It is often attended with sickness; and in many instances it is periodical, coming on every day at a certain hour, lasting a certain time, and then subsiding. Like the other forms of neuralgia, hemicrania may be produced by various causes, which are, however, almost all of them such as tend to debilitate the system: it sometimes occurs in connection with hysteria; sometimes it plagues women who have suckled their infants too long; sometimes it acknowledges the same cause as ague; and sometimes also it occurs independently of all other disease, and when no obvious exciting cause can be traced.

Whatever may be its origin, it is usually a very manageable complaint. When it is associated with evident anæmia, steel and the shower-bath may be expected to cure it. When its visits are strictly periodical, it will yield to quina. Arsenic is considered by many to have a specific power over the complaint; and I believe that four or six drops of the liquor arsenicalis, given three or four times a-day, with due attention to the state of the bowels, will be almost sure to remove hemicrania in nine cases out of ten in which it occurs. But steel or bark, being milder and safer drugs, are, *cæteris paribus*, to be preferred.

I say this disorder often acknowledges the same *cause* as *ague*; namely, the miasm of marshes, or malaria: and as that cause, mysterious as it is in some respects, exerts apparently its primary or chief influence upon the nervous system, and as ague has no definite seat in the human body, if it be not in the nervous system, I shall not find a more convenient place in these lectures for the consideration of ague than here, at the close of the remarks which I had to make respecting the diseases of the brain and nerves. In the next lecture, then, I shall begin to speak of Intermittent Fever.

LECTURE XXXV.

Intermittent Fever. Phenomena of an Ague Fit. Species and varieties of Intermittents. Predisposing causes. Exciting cause. Malaria: known only by its effects; places which it chiefly infests; conditions of its production; its effects upon the human body; influence of soils in evolving it.

I AM now to enter upon the consideration of that disorder of which the trivial English name is *ague*, and which is called by nosologists *intermittent fever*. This is one of the diseases which are known to us only in their respective group of symptoms. Before we can enquire successfully into its history, it is necessary that we have the group of symptoms which identify it set fairly before us. I must first, therefore, describe the *phenomena* of ague.

Observe, in the outset, that ague resembles several other maladies which belong essentially to the nervous system, in being *paroxysmal*. A certain series of symptoms occurs, and then the patient reverts to his ordinary state of health: but this alternation commonly happens (or would happen if the disease were left to itself) several or many times. You may therefore look upon this succession of attacks as so many repetitions of a short distemper; or you may regard the whole period during which the attacks continue to recur at brief intervals, as being occupied with one single disease.

An ague fit is composed of three distinct stages: and they are severally named, from the phenomena that characterise them, the *cold*, the *hot*, and the *sweating* stage.

A person who is on the brink of a paroxysm of ague, experiences a sensation of debility and distress about his epigastrium; becomes weak, languid, listless, and unequal to bodily or mental exertion. He begins to sigh, to yawn, to stretch himself; and soon he feels chilly, particularly in the back along the course of the spine; the blood deserts the superficial capillaries; he grows pale, his features shrink, and his skin gets dry and rough, drawn up into little prominences, such as may at any time be produced by exposure to external cold, and presenting a surface somewhat like the skin of a plucked goose: hence it is called goose's skin, and in Latin *cutis anserina*. Presently the slight and fleeting sensation of cold, first felt creeping along the back, becomes more decided and more general: the patient *feels* very cold, and he *acts* and *looks* just as a man does who is exposed to intense cold, and subdued by it; he trembles and shivers all over; his teeth chatter, sometimes so violently that such as were loose have been shaken out; his knees knock together; his hair bristles slightly, from the constricted state of the integuments of the scalp; his cheeks, lips, ears, and nails turn blue; rings which before fitted closely to his fingers become loose; his respiration is quick and anxious; his pulse frequent sometimes, but feeble; and he complains of pains in his head, back, and loins; all the secretions are usually diminished; he may make water often, though generally he voids but little, and it is pale and aqueous; his bowels are confined, and his tongue is dry and white.

After this state of general distress has lasted for a certain time, it is succeeded by another of quite an opposite kind. The cold shivering begins to alternate with flushes of heat, which usually commence about the face and neck. By degrees the coldness ceases entirely; the skin recovers its natural colour and smoothness; the collapsed features and shrunken extremities resume their ordinary condition and bulk. But the reaction does not stop here; it goes beyond the healthy line. The face becomes red and turgid; the general surface hot, dry, and pungent; the temples throb; a new kind of headache is felt; the pulse becomes full and strong, as well as rapid; the breathing is again deep, but oppressed; the urine is still scanty, but it is now high coloured; the patient is exceedingly uncomfortable and restless. At length another change comes over him: the skin, which, from being pale and rough, had become hot and level, but harsh, now recovers its natural softness; a moisture appears on the forehead and face; presently a copious and universal sweat breaks forth, with great relief to the feelings of the patient; the thirst ceases; the tongue becomes moist; the urine plentiful but turbid; the pulse regains its natural force and frequency; the pains depart; and by and by the sweating also terminates, and the patient is again as well, or nearly as well, as ever.

Surely this is a very remarkable sequence of phenomena: and it would appear still more remarkable if it were less familiar to us. The earlier symptoms are all indicative of debility; of a depressed state of the vital power. There is the same sensation of exhaustion, with incapacity of exertion, which is produced by fatigue. The sighing, yawning, and stretching, all notify debility. The paleness of the surface, and constriction of the skin, and collapse of the features, are all owing to the retirement of the blood from the superficial capillaries. The skin shrinks, but the parts containing the bulbs of the hairs cannot contract so much as the other parts, and therefore the surface becomes rough, and the hairs bristle up, or become in some degree erected. *Horripilatio* is the learned term for this state of the surface. The coldness of the skin is another consequence of the emptiness of its blood-vessels; and the tremors, which are always indicative of debility, seem to depend upon the coldness. The chattering of the jaws has been (it is said) so violent as to fracture the teeth. This you may believe or not as you please, but certainly his whole bed is often strongly shaken by the shiverings of the patient. The necessary accumulation of the blood in the larger and internal vessels offers a reasonable explanation of the distressed and anxious breathing.

In their attempts to render a 'ratio symptomatum,' authors have sometimes spoken of the hot stage as though it were a necessary consequence of the cold. But if the cold fit be in any sense or degree the cause of the hot fit, it can only be so partially. There must be some other cause; for these reasons. The cold stage may occur and never be followed by the hot; or the hot stage may come on without any previous cold stage; and when they do both happen, they are not by any means proportioned to each other. When we thus see that a supposed cause is not always followed by the effect, and that the effect is sometimes produced without the agency of the supposed cause, and also that the supposed cause and the effect are out of proportion to each other, we cannot but conclude that the supposed cause is at most but a partial and accessory cause. We can more easily conceive how the hot fit may conduce to bring on the sweating stage. The stronger action of the heart and the more forcible propulsion of the blood will fill the superficial vessels, and in this way the natural secretions may be restored. We see exactly the same thing happen when the force of the circulation is increased by exercise: the extreme vessels receive a larger supply of blood, and sweat ensues.

There are many curious facts to be noticed respecting the paroxysm of an intermittent, such as it has been now, in general terms, described. In the first place the paroxysm *returns*. Cullen makes this a part of his definition; and quibbling objections to his statement have been made, which are scarcely deserving of mention. Thus it is said that this circumstance should not have been introduced into the definition, because it is not *necessarily* or *universally* true; that the patient *may die* in the *very first* paroxysm; or that he may be cured by the proper remedies of ague, *before a second* paroxysm has time to show itself. But all this is captious trifling. The paroxysms, if the disease be left to itself, will recur again and again; and, unlike the paroxysms in many of the spasmodic diseases which we have lately been speaking of, they recur at regular periods, and often with singular punctuality. This is a circumstance which we should waste our time in attempting to account for. Dr. Cullen has tried to explain it on the principle of some diurnal *habit* of the body; but the truth is, that no *satisfactory* explanation of it has ever been given, and we must be content, for the present at least, to receive it as an ultimate fact; and doubtless a very strange and interesting fact.

For distinguishing some equally curious varieties of these successions and alternations of disorder and health, certain terms have, by common consent, been adopted by pathologists; which terms it is requisite that I should explain. The period that elapses between the *termination* of one paroxysm and the commencement of the next is called an *intermission*; while the period that intervenes between the *beginning* of one paroxysm and the beginning of the next, is called an *interval*. As the paroxysms are liable to vary in length, the intermissions may be very unequal, even when the intervals are the same. When the intermissions are perfect and complete, the patient resuming the appearance and sensations of health, the disorder is an *intermittent* fever. When the intermissions are imperfect, the patient remaining ill and feverish and uncomfortable in a less degree than during the paroxysm, then the complaint is said to be a *remittent* fever.

But, confining ourselves for the present to intermittents, it is another curious property of this complaint that, although the intervals are commonly constant in each case, and quite regular, they differ in duration in different cases. Upon this circumstance is founded a division of agues into species. When the paroxysm occurs at the same hour *every day*, the patient is said to have *quotidian* ague. When it comes on at the same hour *every other day*, appearing and remaining absent day by day, alternately, he is said to labour under *tertian* ague. The paroxysm, strictly speaking, repeats itself every *second* day:

and if the species I first mentioned be fitly termed quotidian, that in which the fits occur on alternate days ought to be styled *secundan*. But nosologists have chosen to reckon the day on which the preceding fit happens as the first: and then the day on which the fit next to it will happen, in the species now under consideration, is the third. In the same way, when a paroxysm absents itself for two whole days, and then returns, the complaint is called a *quartan* ague. These are the three principal species or types of intermittent fever. It follows, of course, from what I have been stating, that in the quotidian type the interval is twenty-four hours; in the tertian, forty-eight; and in the quartan, seventy-two.

Each of these types has some other characters peculiar to itself. Thus, the paroxysms of the quotidian ague begin in the morning; those of the tertian, at noon; those of the quartan, in the afternoon. These are the *rules*. You are not to expect to find them always or rigidly observed; for the most part you will find that they *are* observed. It is probable that quotidian paroxysms, occurring at noon or at night, have sometimes been ascribed to ague, when they were merely symptoms of some local disease or inflammation; or perhaps accessions of *hectic* fever. It is observed also of the paroxysms, that when the disease is about to yield, they often occur later day after day, before they take their final departure. This is called *postponing*, and when they occur earlier than their stated hour, the paroxysms are said to *anticipate*. Now a postponing quotidian may be deferred till noon. But when the disease is pursuing its regular undisturbed course, the rule is such as I have mentioned.

The three principal types differ from each other, not only in their respective intervals, and in the periods of the day at which the paroxysms severally commence, but also in the *duration* of the paroxysms; and in the proportions which the stages of these paroxysms bear to each other. The average duration of the paroxysm in the quotidian is ten or twelve hours; and of course the average duration of the intermission is nearly the same. The tertian paroxysm commonly begins at noon, and is finished the same evening; its average duration may be estimated at six or eight hours. And that of the quartan does not exceed four or six hours.

You must observe also that while the quartan has the longest interval and the shortest paroxysm, it has the longest cold stage; whereas the quotidian has the shortest interval and the shortest cold stage, but the longest paroxysm. To express these facts in mathematical language, the length of the paroxysm varies inversely as the length of the cold stage; inversely also as the length of the interval.

Of these three principal types or species, the tertian is by much the most common: but the quotidian and quartan are neither of them unfrequent wherever ague is rife.

I should tell you that there are other types also spoken of, as quintans and sextans: but they are scarcely worth our attention. It is probable that when they are noticed (and that is very rarely) they are merely irregular quartans, postponing perhaps for a day or two. They never prevail epidemically. Galen describes one of these; so does Van Swieten. Boerhaave talks of a septiman, and even octavans are mentioned; or if you desire still more of the marvellous, Pliny, the naturalist, informs us that a certain Improvisatore was in the habit of having a paroxysm once a year. It came exactly on his birthday; yet he died at a good old age.

There are, however, some curious modifications of the three principal types; or rather of two of them, the tertian and the quartan. For instance, a paroxysm may occur daily, and yet the ague not be of the quotidian type, but of the tertian. The paroxysm of one day will differ from the paroxysm of the next, but exactly resemble that of the third day; while the paroxysm of the second day will be like that of the fourth; and so on alternately. And these differences will be decidedly marked: the paroxysms of two consecutive days will come on at different hours, and will differ in duration and severity. This form of ague is called the *double* tertian. One case of this kind, very distinctly characterised, was some time ago under my care in the hospital.

There is another form of double tertian. Two fits shall occur on the same day—Monday, for example—one in the morning, the other in the evening; on Tuesday there shall be no fit; on Wednesday again two; on Thursday none; and so on. The Latin nomenclature is more precise than the English in denoting these variations. The form I have last mentioned, in which two dissimilar paroxysms occur every other day, is called tertiana *duplicata*, while the other form, in which there is a fit every day, but those on the alternate days resemble each other, is called tertiana *duplex*.

In the same way you may have a double quartan. In that case, a paroxysm occurs on two days in succession, and leaves the third day free; then it returns on the fourth day as it was on the first, and on the fifth as it was on the second, and leaves the sixth day free like the third, and so on. This is the quartana duplex. But two fits may happen on one day—say on Monday; none on Tuesday or Wednesday; and two again on Thursday. This is the quartana duplicata. Nay, the paroxysm of quartan ague may recur every day, and so far resemble a quotidian; but the fit of the first day will differ from those of the second and third, and resemble that of the fourth; the fit of the second day will be dissimilar from that of the first and that of the third, and like that of the fifth; and the fit of the third will be unlike that of either of the two preceding days, and find its counterpart in that of the sixth. This is a triple quartan: and where three paroxysms occur on the first day, which we will again suppose to be Monday, and none on Tuesday or Wednesday, but three again on Thursday, corresponding respectively to the first three, we have the quartana triplicata. And there are other complications still, with which I need not trouble you. In Dr. Cleghorn's book on the diseases of Minorca, you may find a very good and authentic account, evidently drawn from nature, of the irregular types and varieties of ague. They are well worthy of the attention of any among you who may be likely to practise abroad.

Some physicians have used the words *double* tertian, and so on, in the literal sense, and have supposed that two or more distinct agues coexisted. This savours of the error that I formerly warned you against, of looking upon diseases as separate entities, and not as merely modes of being and of acting, different from those which are proper to the state of health. The vulgar always regard disorders in this light. A coachman by whose side I sat while travelling from Broadstairs to Margate, was speaking of the rarity of ague in that part of the Isle of Thanet. His father, he said, once had the complaint, and a fit came on while he was on a visit to him, the coachman, at Ramsgate. The son administered to his suffering parent a glass of brandy; whereupon 'he threw the agey off his stomach; and it looked for all the world like a lump of jelly.' That was the only occasion on which he had ever '*seen* the agey.'

Besides these varieties in *type*, some other deviations from the regular form of the paroxysm require to be noticed.

Sometimes the paroxysm is *incomplete*: it is shorn of one or more of its stages: the heat and sweating occur without any previous rigors; or the patient shakes, but has no subsequent heat; or the sweating stage is the only one of the three that manifests itself. These fragments of a fit are often noticeable when the complaint is about to take its departure; but they may also occur at other periods of the disease. Sometimes there is no distinct stage at all: but the patient experiences frequent and irregular chills, is languid and uneasy, and depressed. This state is commonly known among the inhabitants of our fenny and aguish districts as the *dumb* ague, or the *dead* ague; the patient is said not to *shake out.*

Again, there is often remarked a tendency to a change of type in the course of the same disease affecting the same person. Thus a quotidian may be transformed into a tertian; a tertian into a quartan; or, on the other hand, a quartan into either of these. I have already noticed the fact that the paroxysms may also alter their time of invasion, sometimes coming later and later in the day at each recurrence, sometimes earlier and earlier. When the paroxysm so *postpones*, the disease is getting milder: when it *anticipates* its usual period of attack, the disease is increasing in severity. The postponement or anticipation, therefore, of the fit has a close relation to the prognosis.

The most singular instance of variety that I have heard or read of, is referred to by Dr. Ranking (in his 'Retrospective Address,' 1846), as recorded by M. Maugenet. In this case the usual order of the stages was reversed. 'The patient, upon each accession of the fit, was first attacked with profuse sweating, which lasted for an hour. Then the skin became dry and hot, and the face flushed, with headache, &c. This stage lasted ordinarily for five hours, when the patient began to feel cold,. and eventually had distinct rigors.' Quina was as effectual in this remarkable variety, as I shall presently show you that it is in the more regular forms of ague.

There are yet other cases, in which from first to last no determinate type or order of succession is observed by the paroxysms; and these cases authors speak of as *erratic* forms of ague.

There are also many modifications or complications observable in the symptoms which constitute the fits. Occasionally each paroxysm is attended by violent delirium: this is most common, I believe, in the hot stage. This symptom has been known to be almost constant throughout an epidemic. Sometimes the patient is convulsed in the paroxysm; or syncope comes on; or tetanic rigidity; or petechiæ take place on the skin, and disappear with the paroxysm. These deviations from the common and regular kind and order of the symptoms may sometimes depend upon the constitutional predispositions of the person affected; but there is another way also in which they may be explained. I shall presently have a good deal to say upon the one grand—I may say *sole*—exciting cause of intermittents. Now exposure to that cause, a residence in aguish districts, will sometimes impart a periodic character to *other diseases*; and I apprehend that this explanation will apply to many of the instances which have been observed of hysterical, tetanic, or other paroxysmal complaints occurring at perfectly regular intervals.

The duration of ague—of the whole disease, and not merely of a separate paroxysm—it is not easy to estimate. If persons who laboured under it were always removed at once from the influence of the exciting cause, and were always suffered to remain without treatment calculated to check the malady, we might then find materials for determining its average natural duration. But we have not these data. In point of fact, ague sometimes consists of a few paroxysms only, half a dozen, or four, or three, or even of one fit; and on the other hand, the fits may be protracted over a space of several weeks or months; nay, of many years.

An ague may attack a person at any time; but they are much more common in spring, and in autumn, than in the other seasons of the year: so that you will hear and read a good deal of *vernal* intermittents, and of *autumnal* intermittents. The autumnal agues are, *cœteris paribus*, the more severe and dangerous. The quotidian is most common in the spring; the quartan in the autumn; and the tertian is frequently met with both as a vernal and as an autumnal ague. You will bear in mind that in all this I am stating the prevailing *rules*; which are liable to numerous exceptions.

Ague is one of those disorders of which (as of common inflammation) all persons, at all periods of their existence, seem to be susceptible, when submitted to the force of the specific exciting cause. Individuals of all ages, from sucking infants to persons of fourscore, are *liable* to it, but they are not *equally subject* to it. It is less likely (*cœteris paribus*) to affect the very young, and the aged, than those of middle life. However, the very old are by no means exempt from the effects of the pernicious influence: and with respect to the very young, some extremely curious statements have been made. It is said that persons have had ague before they were born. We know that the period of intra-uterine life is obnoxious to many forms of disease; for we trace the consequences of such disease, in visible changes of structure, immediately after birth. Pulmonary tubercles constitute one malady to which the fœtus in utero is liable: hydrocephalus is another: acute inflammation of the peritoneum a third. And there can be no doubt that various specific poisons influence, occasionally, the included being, even although they may have no sensible effect upon the parent. The fœtus may thus contract small-pox, which sometimes proves fatal to it, sometimes not. The daughter of my bed-maker at Cambridge had a child ill of hooping-cough in the house with her while she was in the last months of pregnancy; and the infant in the womb must have caught the disease, for I was assured that he hooped the very day he came into the world. The sins of the parent are thus visited often upon the child, when, before its first breath is drawn, its frame is contaminated by the virus of syphilis. And in like manner unborn infants are capable of being affected by the poison that produces ague. One case in proof of this is recorded by Dr. Russell, in his 'History of Aleppo.' The woman had tertian ague, which attacked her, of course, every other day: but on the alternate days, when she was well and free, she felt the child shake; so that they both had tertian ague, only their paroxysms happened on alternate days. Bark was prescribed for her; and it cured the little one first, and afterwards it cured the mother.

One probable reason why ague more commonly affects persons about the middle period of life, than those near its extremes, is, that the former are much more likely to be exposed to the primary exciting cause. And the same reason may be given, I presume, for another fact; viz., that the complaint is much more frequently seen in men than in women.

Among the circumstances which predispose to ague, debility has a powerful influence. It is important to be aware of this, as it concerns the prophylaxis, and the management of the patient after the disease has been subdued. Soldiers have been exposed to the exciting cause, without becoming affected by it, while strong and in good health; and have fallen ill of intermittent fever upon being weakened by exertion and fatigue. When I have told you that debility, any how produced, constitutes a predisposition to intermittent fever, I need scarcely add that all the multiform causes of debility may also be regarded as predisposing causes of this same disease; as they are of so many others.

But the strongest predisposing cause of all is a previous attack of the disease itself. The effect of former intermittents upon the system is such, that the complaint may be reproduced by agencies which under any other circumstances would be quite inoperative for exciting ague. I have stated already my persuasion that, strictly speaking, there is but one exciting cause of intermittent fever; but in making that statement I refer to its *first production.* The disease leaves the body in a condition in which other injurious influences may, of themselves, be sufficient to renew it. It brings into play a new order of exciting, or rather of re-exciting, causes. If a person were never exposed to the malaria, he would never, as I believe, have ague: but having once had ague, he may many times have it again, although he should never again be subjected to the direct influence of the malaria. The late Dr. James Gregory, of Edinburgh, had a brother-in-law who illustrated well in his own person the effects of predisposing circumstances in respect of ague. This gentleman was a strong active man, and commanded a battalion in the West Indies: and he escaped for a long time, while others were falling down around him in remittent fever. At last he was wounded by a musket-ball, which passed through his shoulder. He insisted, much against the will of the surgeon of the regiment, on resuming his duties before his strength was completely restored; and the consequence was that he was immediately attacked by a remittent fever of such violence, that his life was for some time despaired of. But this was not all. The remittent disease assumed by degrees a distinctly intermittent form, and became a tertian: and at last he got well and strong, and came over to this country. Yet for a long while, though to all appearance his health was re-established, ague-fits would from time to time occur; and they came precisely at the day and hour on which they would have happened if the tertian had continued with its original type; and slight causes were sufficient to reproduce them. He had marked, in an almanack, the days of the expected accession; and on those days it recurred, for some time, whenever the *east wind blew.* This very circumstance, the east wind, is a *common* re-exciting cause in such cases; exposure to damp cold in any way is another.

The curious fact which this instance exemplifies of the extension of the periodic law, in cases of relapse, throughout long intervals of apparent health, has since been noticed by Dr. Graves; who doubtless was not aware that Dr. Gregory had already observed the tendency thus lastingly impressed upon the system by the cause, or by the once occurrence, of an ague-fit. 'The periodic rate is carried on, although (to quote Dr. Graves' happy illustration) as in a clock from which the striking weight has been removed, the usual signal does not mark the termination of each certain definite portion of time.'

The *exciting cause* of intermittent and remittent fevers—the primary exciting cause I mean, that without which ague would never occur at all—deserves a somewhat particular consideration. I need scarcely say that it is believed to consist in certain invisible effluvia or emanations from the surface of the earth, which were formerly called marsh miasmata, but to which it has, of late years, become fashionable to apply the foreign term *malaria.* In some respects the latter designation is the more convenient of the two.

The malaria is a specific material poison, producing specific effects upon the human body. In its medical sense, it is not simply bad air, or impure air, although the word is loosely employed by many to express any mixed kind of contamination of the atmosphere. Thus we hear of the malaria of London: but ague, even when it occurs in London, is very seldom indeed, now-a days, of London growth. The impure air incident to large and populous cities is prejudicial enough to health, as I formerly took occasion to show you, but it does not *generate* intermittent fever. Whether, and under what circumstances if ever, it may generate some form of continued fever, are questions which I shall examine hereafter.

The emanations which cause ague have been called marsh miasmata, because they are notoriously common in marshy places. But they are not peculiar to marshy places. For this reason, and for brevity's sake, I prefer using the single word *malaria.* In this country, thank God, we witness its milder evils only, and those not very often; but it is the bane and scourge of large portions of the world. Whether you practise here or abroad, it is very fit that you should know the qualities, habitats, and habits, of this wide-spread poison. The mildest form of fever to which it gives birth is the intermittent fever, or ague; but in climates and places where it exists in greater abundance and intensity, the fever becomes remittent, or even assumes the continued form. This has led to strange errors, and proved a fertile source of difference and controversy amongst medical men: not a few of whom confound the severe continued fevers which spring from the malaria, and which are never contagious, with the severe continued fevers usually called typhous, which are unquestionably communicable from person to person.

The effluvia which thus form the sole exciting cause of intermittent and remittent fevers are believed, I say, to proceed from the surface of the earth, and are probably gaseous, or aëriform: at any rate they are involved in the atmosphere. But they are imperceptible by any of our senses. Of their physical or chemical qualities we really know nothing. We are made aware of their existence only by their noxious effects; and the inference that they exist was not made till within the last century and a half. Time out of mind, indeed, it had been matter of common observation that the inhabitants of wet and marshy situations were especially subject to these definite and unequivocal forms of disease. But the Italian physician, Lancisi, was the first, so far as I know, to put forth distinct ideas concerning malaria, in his book, published about 1695, 'De noxiis paludum effluviis.' This is the great original work upon the subject.

To the production of this deleterious agent, a certain degree of temperature seems necessary. It does not appear to exist within the Arctic circle: nor does it manifest itself during the colder seasons of more temperate climates. It is very seldom traceable beyond the 56th degree of north latitude; and it is supposed to require for its development a continuous temperature higher than 60° of Fahrenheit's thermometer. The nearer we approach the equator, the more abundant, virulent, and pernicious does the poison become, wherever it is evolved at all. In this climate it gives rise to intermittents, and principally to tertians. As we go south, in Spain, and along the shores of the Mediterranean, the remittent becomes the predominant form; and (what is very instructive) remittents there contracted often improve into intermittents upon the removal of the patient to a colder climate. Under the tropical heats, in the West Indies, for example, the fevers very frequently assume the continued form.

And another condition of the development of the poison soon becomes apparent. It requires a certain degree of moisture. Of all these regions, malaria, showing itself always by its effects alone, infests certain parts only; which parts are, most generally, remarkable for their humid and swampy character. Thus, in this island, intermittents are generated chiefly, I may say almost exclusively, along the eastern coast; in parts of Kent, Essex, Cambridgeshire, Norfolk, Lincolnshire, and the East Riding of Yorkshire: and in each of these counties there are marshes, or fens, or low grounds and lands that are occasionally overflowed with water. Many of these spots have, within the last fifty or sixty years, been drained, and brought under cultivation; and agues are consequently much more rare in England than they formerly were. In Sydenham's time they were very frequent, and very fatal indeed, in this metropolis. James I., and Oliver Cromwell, both died of ague contracted in London. At present (as I said before) we seldom meet with them. Except in the year 1827, I have never, since I have been in practice, known ague to be at all prevalent here. This comparative freedom from malaria is mainly owing, no doubt, to the improved character of the draining and sewerage.

The year 1859, in its earlier portion, was a remarkably dry year; and it was remarkably fruitful of ague in certain districts of England which for many previous years had been almost exempt from the disease.

Agues, or aguish fevers, are endemic along every part of the low and level coast of Holland. In Italy, the Pontine marshes, near Rome, have possessed for ages an infamous celebrity of the same kind. The whole of the district called the Maremna—stretching for about thirty leagues along the shores of the Mediterranean, and in some places ten or twelve leagues broad—is rendered dangerous, and almost uninhabitable, by the vast quantity of malaria annually evolved from its soil. In America large districts are, for the same reason, prolific of disease. The late Bishop Heber, in his 'Narrative of a Journey through the Upper Provinces of India,' gives the following striking picture of the influence of the malaria in that part of the world. It seems to be alike pestiferous to man and beast.

'I asked Mr. Boulderson if it were true that the monkeys forsook these woods during the unwholesome months. He answered that not the monkeys only, but everything which has the breath of life, instinctively deserts them from the beginning of April to October. The tigers go up to the hills; the antelopes and wild hogs make incursions into the cultivated plain; and those persons, such as dâk-bearers, or military officers, who are obliged to traverse the forest in the intervening months, agree that not so much as a bird can be heard or seen in the frightful solitude. Yet during the time of the heaviest rains, while the water falls in torrents, and the cloudy sky tends to prevent evaporation from the ground, the forest may be passed with tolerable safety. *It is in the extreme heat, and immediately after the rains have ceased*, in May, the latter end of August, and the early part of September, *that it is most deadly.* In October the animals return. By the latter end of that month the wood-cutters and the cow-men again venture, though cautiously. From the middle of November to March troops pass and repass, and with common precaution no risk is usually apprehended.'

Persons who live in England might perhaps be disposed to think lightly of the malaria, had not such fearful evidence of its appalling power been brought home to the experience of our countrymen, in the early part of the present century, by the results of the unfortunate expedition to Walcheren. Sir Gilbert Blane has given an account of the ravages it there committed among our troops. You may see his paper, to which I shall presently again refer, in the third volume of the 'Medico-Chirurgical Transactions.'

Not only a certain degree of heat, and a certain quantity of moisture, but the presence of all the four elements of the ancients would appear to be requisite for the production of this poison. Air of course there must be; and earth also is essential. If heat and moisture were alone adequate, we should find the fever prevailing among sailors when out at sea: but it is not so, whatever may be the temperature under which they cruise. It is when they approach the coast, and land upon it, that they are attacked. The water of marshes has been examined under the microscope, and analysed again and again, with a view to the discovery of the nature of this pestilential agent; but in vain. A more likely way to detect the noxious material would seem to be by examining the *air* of malarious districts; and this has been done carefully and repeatedly by expert chemists; and with the same want of success. The poisonous principle eludes the test of the most delicate chemical agents.*

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* In 1862, Dr. Salisbury, of Cleveland in Ohio, persuaded himself that he had discovered the substantial exciting cause of Intermittent Fever, in the minute spores of certain species of Palmellæ (low vegetable organisms belonging to the group of algæ), which he found invariably present wherever ague was endemic, and which he calls accordingly ague-plants. Dr. Salisbury holds that these spores rise at night above the surface of the ground, and are sus-

Where there is much heat, and much moisture, there we usually find also much and rank vegetation, and much vegetable dissolution and decay. The belief was as natural, therefore, as it has been general, that the putrefaction of vegetable matters was somehow or other requisite to the formation of the poison that exists so commonly in swampy situations. This belief has descended, almost unquestioned, from the time of Lancisi; and it obtains almost universal acceptance, I fancy, among physicians of the present day. Yet very strong facts have been adduced to show that the decomposition of vegetable substances is only an accidental, though a frequent, *accompaniment* of the miasm; and not by any means an essential condition of its evolution.

In the first place, the decomposition of vegetable matter goes on abundantly without the production of malaria. The rotting cabbage-leaves of Covent Garden, and those which taint the air of the streets from the neglected dust-holes of London, during the hot weather of summer, give rise to no ague. The same may be said of the putrefying and offensive sea-weeds which are deposited in large quantities upon some very healthy parts of our coast. But the converse facts are the most remarkable and conclusive. I have stated that *marshes* are not necessary to produce malaria; but Dr. William Ferguson—a physician who had, and who well used, very sufficient opportunities of investigating the question—shows that *vegetation* is not necessary: that the peculiar poison may abound where there is no decaying vegetable matter, and no vegetable matter to decay. As the prevailing belief is, in my opinion, an erroneous one, and as it is really of great importance that correct views of this subject should be taken and disseminated by medical men, I will mention a few of the most striking of the facts detailed by Dr. Ferguson. They are contained in a very interesting paper *On the Nature and History of Marsh Poison*, published in the 'Edinburgh Philosophical Transactions.'

In August 1794, after a very hot and dry summer, our army in Holland encamped at Rosendaal and Oosterhout. The soil, in both places, was a level plain of sand, with a perfectly dry

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pended in the cold and damp exhalations of the soil after sunset, and fall again soon after sunrise; so that the day air is free from them.

This must be reckoned a great discovery, if its truth can be established. Dr. Salisbury's doctrine seems irreconcileable with some of the facts ascertained by Dr. Wm. Ferguson, and needs further confirmation before it can with any confidence be accepted.

surface, where no vegetation existed, or *could* exist, save stunted heath plants. It was universally percolated to within a few inches of the surface, with water which, so far from being putrid, was perfectly potable. Here fevers of the intermittent and remittent type appeared among the troops in great abundance. It is interesting to observe that the soil in Walcheren is precisely similar. Sir Gilbert Blane describes it as consisting 'of a fine white sand, known in the eastern counties of England by the name of silt, and about a third part of clay.' It was after a dry and hot summer also that the British army suffered in that island from the endemic fever, to a degree which Dr. Ferguson speaks of as 'being almost unprecedented in the annals of warfare.'

In the year 1809, several regiments of our army in Spain took up an encampment in a hilly ravine which had lately been a watercourse. Pools of water still remained here and there among the rocks, so pure that the soldiers were anxious to bivouack near them for the sake of using the water. Several of the men were seized with violent remitting fever before they could move from the bivouack the next morning. 'Till then (says Dr. Ferguson) it had always been believed amongst us that vegetable putrefaction (the humid decay of vegetables) was essential to the production of pestiferous miasmata; but in the instance of the half-dried ravine before us, from the stony bed of which (as soil never could lie for the torrents) the very existence even of vegetation was impossible, it proved as pestiferous as the bed of a fen.'

After the battle of Talavera, the army retreated along the course of the Guadiana river, into the plains of Estremadura. The country was so arid and dry from want of rain, that the Guadiana itself, and all the smaller streams, had in fact *ceased to be streams*, and were no more than lines of detached pools in the courses that had formerly been rivers. The troops there 'suffered from remittent fevers of such destructive malignity, that the enemy, and all Europe, believed that the British host was extirpated.'

Ciudad Rodrigo is situated on a rocky bank of the river Agueda, a remarkably clear stream: but the approach to it on the side of Portugal is through a bare open hollow country, that has been likened to the dried-up bed of an extensive lake; and upon more than one occasion, when this low land, after having been flooded in the rainy season, had become as dry as a brick-ground, with the vegetation utterly burned up, there arose among our troops, fevers which, for malignity of type, could only be matched by those which occurred on the Guadiana.

Many more facts to the same purpose are related in Dr. Ferguson's paper, which is in every way well worth your perusal. He tells us 'that in the most unhealthy parts of Spain, we may in vain, towards the close of the summer, look for lakes, marshes, ditches, pools, or even vegetation. Spain, generally speaking, is then, though as prolific of endemic fever as Walcheren, beyond all doubt one of the driest countries of Europe; and it is not till it has again been made one of the wettest, by the periodical rains, with its vegetation and aquatic weeds restored, that it can be called healthy, or even habitable with any degree of safety.'

Our time will not allow of my extracting any further evidence on this point; one circumstance of contrast, however, I am unwilling to omit.

The river Tagus at Lisbon is about two miles broad; and it separates a healthy from a very unhealthy region. On the one side is a bare hilly country; the foundation of the soil and of the beds of the streams being rock, with free open water-courses among the hills. This is the healthy side. But the Alentejo land, on the other side, though as dry superficially, being perfectly flat and sandy, is most pestiferous. Moreover, in and near Lisbon there are numerous gardens, where, during the three months' absolute drought of the summer season, they keep water in stone reservoirs. These reservoirs, containing water in the most concentrated state of foulness and putridity, are placed close to the houses and sleeping rooms: the inhabitants literally live and breathe in their atmosphere. 'Yet no one ever heard or dreamt of fever being generated amongst them from such a source; though the most ignorant native is well aware that were he only to cross the river, and sleep on the sandy shores of the Alentejo, where a *particle* of water at that season had not been seen for *months*, and where water, being absorbed into the sand as soon as it fell, was *never* known to be *putrid*, he would run the greatest risk of being seized with remittent fever.'

Now these facts, and facts like these, seem to prove that the malaria, and the product of vegetable decomposition, are two distinct things. They are often in company with each other, but they have no necessary connection. Whoever, in a malarious country, waits for the evidence of putrefaction, will wait, says Dr. Ferguson, too long. For producing malaria it appears to be requisite that there should be a surface capable of absorbing moisture, and that this surface should be flooded and soaked with water, and then dried: and the higher the temperature, and the quicker the drying process, the more plentiful and the more virulent (more virulent probably because more plentiful) is the poison that is evolved.

The putrefaction of *animal* matter is sometimes spoken of as an element in the formation of the malarious poison. But the evidence I have just set before you refutes this supposition as completely as it excludes the alleged necessity of vegetable decay. I hope to prove to you, in a future part of the course, that neither animal nor vegetable decomposition is sufficient to generate fever of any kind.

Dr. Ferguson's facts are generally in accordance with the observations which others have made upon the same subject; and his views will be found to account for some phenomena which the ordinary theory of vegetable putrefaction did not cleverly explain.

There is good reason for believing that in all cases the poisonous emanations proceed from parts of the surface that have been flooded and then dried, rather than from parts that are still wet, or putrid. And this elucidates a circumstance very often noticed, viz., that neighbouring places—especially high and low lands lying near each other—change their character in respect of salubrity upon the occurrence of rains. The low grounds, which had previously been very dangerous, become healthy when they are flooded over; and the higher lands, which are made wet, and which rapidly dry again, produce the malaria abundantly. For the same reason, the edges or borders of swamps, which of course expand or contract according to the wetness or dryness of the season, are more unsafe than their centres. The drying and half-dried margins of the purest streams may be prolific of the evil, when, from the want of confining banks, those margins have been flooded by the rising of the waters.

There is no observation more general than that, in malarious places, agues and remittent fevers abound more in hot and dry years than in those which are cold and moist. And this influence of temperature it is which mainly determines the differences observable in regard to these fevers at *different elevations*, and in *different seasons* of the year. In the higher grounds of the West Indies *agues* occur, as in this country: as you descend, and the mean atmospheric temperature increases, *remittents* are met with: and in the lowest and hottest parts the fever becomes *continued.* The following instructive facts are stated by Dr. Ferguson. In 1816, the British garrison of English Harbour, in Antigua, was disposed in three separate barracks, on fortified hills surrounding the dockyard. One of the barracks was on an eminence named Monk's Hill, six hundred feet above the level of the marshes. The other two were situate on an eminence called the Ridge, one at the height of five hundred, and the other at the height of three hundred feet. So pestiferous were the marshes among which the dockyard was placed, that it often happened to a well-seasoned soldier, coming down from Monk's Hill, and mounting the night-guard in perfect health, to be seized with furious delirium while standing sentry, and to expire within less than thirty hours after being carried up to his barracks, with a yellow skin, and having had black vomiting. Those in the barracks on Monk's Hill, *who did not come down,* the superior officers, the women, children, and drummers, had no fever of any kind. Seventeen artillerymen, in the barracks at the height of three hundred feet, did not come down to the night-guards. (We shall see hereafter that malarious places are always most dangerous at *night.*) Every one of these men was attacked with remittent fever, of which one of them died. At the barrack on the top of the Ridge, at the height of five hundred feet, there scarcely occurred any fever worthy of notice. Thus, *in the same place,* the malaria, in the level plain, caused continued fever, resembling, and I believe identical with, one form at least of yellow fever: at the elevation of three hundred feet it gave rise to remittent fever: and at the height of five hundred or six hundred feet its influence was scarcely felt at all. In the neighbourhood of the Pontine marshes you see the villages perched curiously on the intervening hills; the Italians having been taught by experience that these elevated spots afford comparative security against the effects of the miasmata.

Wherever the malaria prevails, it produces its peculiar consequences chiefly in certain seasons: and it is in the autumn especially that agues and aguish fevers occur; that is to say, after the heats of summer: and the hotter and drier the preceding summer, the more frequent and fatal are the autumnal fevers. The Pontine marshes lie to the southward of Rome; and Horace, you know, says or sings,

> Frustra *per autumnos* nocentem
> Corporibus metuemus austrum.

The effects of these morbific effluvia upon the human body vary much under different circumstances. Where they are most concentrated and deadly, their operation may be almost immediate. Witness their speedy influence upon the soldiers who descended at night from Monk's Hill. So also sailors who have gone on shore for a single night only, have been attacked by the fever before they could return to the ship. On the other hand, when the emanations are less copious, or less virulent, there is sometimes a long and uncertain period of incubation. The disease remains latent, or the poison lies dormant, for a considerable space of time. Many of the soldiers who were exposed to the malaria at Walcheren did not experience its bad effects until after they had returned, and had even resided several months in England. In the same way, labourers, especially the itinerant Irish, will go down in the autumn for harvest work into Lincolnshire, and bring back the seeds of the disorder within them, and yet may not be attacked with ague for weeks or months; upon the occurrence of an east wind perhaps, or after unusual exposure to cold and wet. We trace, in all this, some analogy with the animal contagions; but the period of incubation is more irregular and accidental; and it is probable that in many instances the ague would not happen at all, but for the concurrent operation of some other malign influence.

Another fact worthy of notice with respect to the agency of the malaria upon the human frame, is that it affects strangers much more readily and decidedly than the natives of the place. In other words, habit mitigates the injurious effects of the poison. Persons become *seasoned* to it. At Walcheren, though almost every adult among the lower classes had laboured, in the course of his life, under the endemic intermittent, yet they were infinitely less subject to it than strangers: and they will not believe that their beloved birthplace is unhealthy. Sir Gilbert Blane says that persons of education, and even medical men, denied indignantly that their country was less healthy than any other; and attributed the sickness which raged among our troops to some trivial circumstance of diet or habits, and not to any insalubrity of the air. This is a curious moral feature, but a very general one. In the pestilential plains of Estremadura the superstitious natives, unable or unwilling to account, through any unwholesomeness of the air, for disease of a type so uncommon among the soldiers, declared that they had all been poisoned by eating mushrooms.

It was found also, at Walcheren, that the strangers who survived the first attacks became thereafter much less liable to the endemic fevers. The French general, Monnet, who had held the command at Flushing for seven years, had acquired a knowledge of this fact, and endeavoured to turn it to practical account. He recommended that troops should not be frequently changed; for when it was the custom to send battalions from Bergen op Zoom every fourth night in succession, to work on the lines of Flushing, these men never failed, upon their return, to be taken ill in great numbers. General Monnet therefore advised, however displeasing it might be to the officers, that a stationary garrison should be retained at Walcheren, in order that the men might be habituated or seasoned to the air (*acclimatés*), and he adduced the instance of a French regiment which suffered in the second year of its being stationed there only one-half the sickness and mortality that it suffered during the first year; and which hardly suffered at all in the third year.

But although the natives and residents in malarious places are not so liable as new comers to the violent and distinct forms of fever, they are chronically affected by the insalubrity of the atmosphere. They are spoken of by travellers as being puny, sallow, and sickly; feeble in body, and spiritless in mind; as having yellow faces, swelled bellies, and wasted limbs; as being subject to dropsies and fluxes; phlegmatic, melancholy, and short-lived.

One remarkable exception is mentioned by Dr. Ferguson. From some peculiarity or idiosyncrasy (which he conjectures may be somehow connected with the texture of the skin) the negro appears to be proof against endemic fevers. ‘To him marsh miasmata are in fact no poison; and hence his incalculable value as a soldier, for field service, in the West Indies. The warm, moist, low, and leeward situations where these pernicious exhalations are generated and concentrated, prove to *him* congenial. He delights in them, for there he enjoys life and health, as much as his feelings are abhorrent to the currents of wind that sweep the mountain tops, where alone the whites find security against endemic fevers.’

No very certain or extensive observations have yet been made with respect to the *kind of soil* from which the miasmata are most apt to be extricated. Such as is loose, penetrable, porous, and sandy, appears highly favourable to their formation. So are soils which, containing much clay, are very retentive of moisture. One curious fact, however, bearing upon this question, seems to have been made out; viz., that what is termed peat-bog, or peat-moss, is not productive of malaria. Many parts of Scotland and of Ireland, that are occupied by large tracts of marsh in which the peat-moss abounds, are completely free from these fevers. Dr. Bisset affirms that the exhalations from black peat-moss do not occasion intermittents, 'at least in high moors under a clear sharp air.' Now in the climate of Virginia, this counteracting influence of a sharp air can scarcely be looked for: yet it is a remarkable fact, that though the provinces of North America, especially North and South Carolina and Virginia, are full of ague, that disease is never seen among the inhabitants near the country of the *Dismal Swamp*, a moist tract of 150,000 acres on the frontiers of Virginia and North Carolina. Weld, the traveller, informs us, that this immense tract is covered with trees, and abounds with water, which appears the moment the shallowest trench is dug. The water is brown, like brandy, but quite clear, and not unpalatable. Its colour is ascribed by the inhabitants to the roots of juniper; and it is said to be diuretic. (CRAIGIE.)

LECTURE XXXVI.

Ague, continued. Speculations respecting its periodicity. Habits and properties of the malaria; most noxious at night; lies near the ground; is carried along by winds; cannot pass across water; attaches itself to trees; is diminished by the increase of cultivation and of population. Ultimate effects of the poison on the body. Ague formerly thought salutary. Prognosis. Propriety of stopping the disease.

You will remember the progress we made, at our last meeting, in the subject of intermittent fever. I described the ordinary phenomena of a paroxysm of ague; and afterwards mentioned certain unusual symptoms with which it is sometimes complicated. The three principal types of ague were also delineated; the quotidian, the tertian, and the quartan: as well as their respective characters, and intervals, and varieties, and changes of type. I spoke too of the predisposing causes of intermittent fever, which may all be briefly included under the head of circumstances that tend to debilitate the body: the strongest predisposing cause of all being a former attack of the disease. And I began to consider the great exciting cause of agues and aguish fevers; the malaria. I first directed your attention to the circumstances under which the malaria appears to be evolved. Since the time of Lancisi it had been very generally supposed that the humid putrefaction of vegetable substances was necessary to the production of this peculiar and widespread poison; and that heat accelerated the putrefactive process. That was Dr. Bancroft's opinion. That also is (I believe) the opinion held, and stated in lectures, by many pathologists at the present time. I showed you, from facts which rest upon Dr. Ferguson's authority, that this notion is founded in mistake: that the products of vegetable decay and decomposition may and do often coexist with malaria, but are distinct and separable from it, and by no means essential to its formation. There is reason to believe that the flooding of a porous earthy surface with water, and a subsequent drying of that surface under a certain degree of heat, constitute the sole or main conditions of the generation of the poison. We found that the effects of the malaria are modified by the temperature of the place: that in low and hot situations it may give rise to an affection not distinguishable in its symptoms from yellow fever; and that in proportion as the locality is higher and cooler, the fever tends to assume first the remittent, and then the intermittent type: that the period of incubation—the period which intervenes between exposure to the malaria and the invasion of the fever—is extremely variable in duration: that the poisonous effluvia affect strangers more certainly and more severely than natives of the place: that persons may become in some sort seasoned to the malarious districts: but that, with the exception of the negroes in the West Indies, the inhabitants of places much infested with the peculiar miasmata are feeble, and sickly, and short-lived.

There was one point which I briefly adverted to, and dismissed perhaps too unceremoniously: I mean the very curious fact of the *regular periodic recurrence* of the paroxysms of intermittent fever. I ought, I think, to have informed you of the views which pathologists have entertained respecting the explanation of that singular circumstance; although it must be confessed that the solution of the phenomenon is still to be sought for. A great number of persons have tried their hands, however, upon this question. Many of the earlier attempts at explanation are either quite hypothetical, or totally insufficient and illogical. Willis ascribed the intermission to a periodic development of the *fermentable matter* in the *blood*. But if any such development took place (of which we have no evidence) we should be no nearer the mark: the question would still recur, why the development of this matter should happen *periodically*: and the same remarks apply to various other so-called explanations brought forward by different writers of considerable reputation. Reil referred the intermittence of fevers to some *general law of the universe*; by which he meant, I believe, some vague generalisation of such facts as the alternation of light and darkness, the periodic recurrence of the seasons, the ebbing and flowing of the tides, the succession of appetite and satiety, of the states of sleeping and waking, and so on: but this evidently is no explanation at all. M. Bailly offers a very singular conjecture upon the subject: he attributes the periodic phenomena to the modification necessarily induced in the human system, and particularly in the function of circulation, by the alternate change of position from the upright to the recumbent, and from the recumbent to the upright, every twenty-four hours; and he adduces in corroboration of this notion the alleged fact that animals, which undergo no such oscillation of posture, are not subject to intermittent fevers. But this is said not to be a fact. Rodet and Charpentier affirm that horses are liable to such complaints. Dr. Macculloch refers to the case of a dog which laboured under a regular tertian ague for some years; the cold paroxysms taking place always at three o'clock in the afternoon. Even if this were not so, M. Bailly's theory fails to account for the occurrence of *continued* fevers. If his views were correct, then we might avoid having ague by refraining from these changes of position from the vertical to the horizontal during sleep, and back again upon waking. More recently M. Roche has put forth the opinion that the attacks of ague are periodic, because the *causes* of them are periodic. And if this could be made out, the conjecture would carry with it some show of reason. He observes that the spring and the autumn are the seasons in which intermittent fevers chiefly break out, especially the autumn: and that during those periods there is a very sensible difference in the temperature and humidity of the atmosphere by day and by night, and even within the space of three or four hours; that a consequent alternation of action and reaction is thus produced in the human body, and soon becomes an established habit. Throughout a part of the twenty-four hours, the operation of the miasmata is slight, or not manifest at all; while during another part of that period it is in full energy, and at about the same time daily. The emanations (which he conceives to proceed from putrefying vegetable matter) are most abundantly disengaged during the hottest part of the day; these watery effluvia are dissolved by the warm air to a certain amount; but after sunset, they are again deposited, and deposited the more copiously in proportion to the coldness of the atmosphere at that time; and coming in contact with the surface of the body, with the mucous membrane of the air passages, and perhaps also with that of the digestive organs, and being absorbed by those surfaces, they occasion the phenomena which constitute an ague fit. The influence of the miasmata being intermittent, we need not wonder, he says, that their effects should be intermittent too: and then he goes on to ascribe the repetition of the paroxysms, after the cause has ceased to be applied, to that tendency observable in the animal system to reproduce certain actions, simply because they have been produced before: in one word, to the effect of *habit.* At length the habit wears out; which accounts for the spontaneous recovery of those who are removed from the malarious district.

It seems to be a very serious objection to M. Roche's theory, that the disease does not show itself, sometimes, for weeks or months after the patient has been exposed to the miasmata. His theory fails altogether also to account for the different *types* of intermittent fever. The differences of type are indeed *opposed* to the theory.

After all it is probable that Cullen had recognised a *part* though not the whole of the truth respecting the periodicity of intermittent fevers, when he ascribed it to some law of the animal economy whereby it is subjected, in many respects, to a diurnal revolution. 'Whether it depends,' he says, 'upon the original conformation of the body, or upon certain powers constantly applied to it, and inducing a *habit*, I cannot positively determine; but the returns of sleep and watching, of appetites and excretions, and the changes which regularly occur in the state of the pulse, show sufficiently that in the human body a diurnal revolution takes place.' But he also is much perplexed with the differences of type; and all that he can say on that point amounts to this—that as the three principal types observe, severally, a particular time of day for their accession, and as quartans and tertians are apt to become quotidians, these to pass into the state of remittents, and these last to become continued; and that as even in the continued form daily exacerbations and remissions are generally to be observed—all this attests the agency of a diurnal revolution.

Suggestions as to some of the influences whereby this diurnal habit or variation may possibly be created and perpetuated, have been thrown out by Professor Laycock of Edinburgh. 'In the first place' (I am quoting from a lecture of his published in the 38th volume of the 'Medical Gazette'), 'we find that the atmospheric tides attain their maximum and mininum at certain hours of the day: for there are tides in the circumambient atmosphere, as well as in the circumambient ocean; and therewith there are also changes in the electricity of the air, and the magnetism of the earth. From 8 to 10, A.M. and P.M., the barometer is at its maximum height; the electric tension is at its maximum too; and there is also the greatest maximum variation east of the magnetic needle at the same hours. From 4 to 5 o'clock, A.M. and P.M., the barometer is at its minimum, and so is also the electric tension. The respiratory movements, and of course the activity of the circulation, are likewise in connection with these hours. About 4 or 5 o'clock in the morning, with a minimum temperature, a minimum electric tension, and a minimum height of the barometer, there is also a minimum consumption of oxygen. Further, I have ascertained by frequent enquiry, that sleep generally comes on about that hour after a feverish and restless night; and what is more remarkable, the statistics of deaths in New York show that the chances are in the proportion of 3 to 2, that the last sleep—the sleep of death—will occur at that hour.'

A most interesting experiment, as it appears to me, performed by M. Brachet upon himself, shows in a strong light the influence of acquired habit in continuing certain unnatural states of the system when once they have been originated: the experiment connects itself also with the peculiar phenomena of intermittent fever. Towards the end of the month of October, in the year 1822, M. Brachet took a cold bath, at midnight, for seven nights in succession, in the river Saone. On the first occasion he remained a quarter of an hour in the river; on the second half an hour; till at length he was able to stay in the water a full hour at a time. After each bath he betook himself to a warm bed, and in a short time became affected with considerable heat, followed by copious perspiration, in the midst of which he fell asleep. At the end of the seven days M. Brachet ceased to repeat this experiment; but what was his surprise at finding, on the following nights, between twelve and one o'clock, that all the phenomena of a true ague fit appeared in due order and succession! As, however, this artificial paroxysm was not very severe, and as he felt quite well during the day, M. Brachet determined not to interfere with it; but to observe the result. Six times it recurred with great regularity. On the seventh night after he omitted the baths, he was summoned, towards midnight, to a woman in labour: the ride to her house heated him, and on his arrival he kept up the heat by placing himself before a large fire, and from that time the febrile phenomena ceased to recur.

The facts and theories which I have thus brought roughly together, with respect to the periodicity of agues, are not without interest, but they show that we have yet much to learn on this subject. Granting that habit may have its share in continuing the regular recurrences, we want some explanation of the return of the second and third fit, after certain determinate intervals, to give a *beginning* to the habit. In respect of the quotidian, Dr. Cullen's *diurnal revolution* might come to the rescue; but this principle evidently will not apply to the tertian type. I know of no two-day, or bidual habit. And the objection holds still more strongly in regard to quartans. Indeed, in quotidians themselves there is much difficulty in applying the explanation, for though by anticipating, or postponing, they *may* come on at different hours of the day, yet their usual and natural paroxysms occur, not in the evening, but in the morning, when, on the principle of diurnal habit, the tendency to exacerbation of febrile action should be the *least.**

Some years ago I ventured to commend this question, of diurnal or periodical influences upon the human body—atmospheric, magnetic, or other—to the attention of the late Mr. Faraday. He was good enough to consider it, and having done so, he called upon me one day to say that he could give me no help towards its solution.

In yesterday's lecture, I pointed out the favourite *habitats*, if I may so speak, of the malarious poison. I have still a few observations to make respecting its ascertained habits and properties. Some of the laws to which it is subject are of great practical importance, and ought to be popularly known; much more ought every medical man to be familiar with them.

In the first place, all malarious districts are (as I have already hinted) much more dangerous *at night* than in the day time. Whether the poison be then more copiously evolved, or whether it be merely condensed and concentrated by the diminished temperature, or whether the body be at that time more susceptible of its influence, it certainly is most active and pernicious during the hours of darkness. To *sleep* at night in the open air in such places is almost to ensure an attack of the fever. Lancisi was quite aware of this, and devotes a chapter to the question. 'Cur juxta paludes noctu præsertim indormientcs magis quam vigilantes lædantur.' It has repeatedly been observed among the crews of ships, when off a malarious coast, that the sailors could go on shore in the day to cut wood, or for other purposes, with impunity, while the men who remained on shore through the night, guarding the water casks, were many or all of them seized with the fever. Take one instance as a sample of many. It is recorded by Dr. Lind. In 1766 the Phœnix ship of war was returning from the coast of Guinea.

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* I would refer the reader to Sir Henry Holland's interesting chapter (in his *Medical Notes and Reflections*, published since these lectures were delivered) "On Morbid Actions of Intermittent Kind."

The officers and ship's company were perfectly healthy till they touched at the island of St. Thomas. Here nearly all of them went on shore. Sixteen of the number remained for several *nights* on the island. Every one of these contracted the disorder, and thirteen of the sixteen died. The rest of the crew, consisting of 280 men, went in parties of twenty or thirty on shore in the day, and rambled about the island, hunting, shooting, and so on: but they returned to the ships at night; and not one of those who so returned suffered the slightest indisposition. Exactly similar events occurred the following year, with the same ship, at the same place, where 'she lost eight men out of ten, who had imprudently remained *all the night on shore*;' while the rest of the ship's company, 'who, after spending the greatest part of the day on shore, always returned to their vessel before night, continued in perfect health.' Many more examples of the same kind are stated or referred to by Dr. Bancroft in his book *on the Yellow Fever*: a book which is rich in information respecting the malaria.

The reapers in the 'Campo Morto'—a well-named part of the Maremma which I yesterday mentioned—are permitted to sleep for two hours about noon. They do so at that time without danger; but when the dews of evening have fallen down upon the earth, which serves them for their bed, it is then that the poison puts forth its most deadly power.* Upon this principle Lancisi admonishes those who in summer travel through the Pontine marshes, not to do so *by night*, as many had been accustomed to do, in order to avoid the greater heat of the day: and similar advice is still given at Rome to all strangers. Though the passage requires but six or eight hours, there are numerous instances of travellers who, in consequence of their having crossed these fens during the night, have been attacked with violent and mortal fevers.

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* In July, 1863, while I was President of the Royal College of Physicians, a very interesting and instructive letter relating to this subject was received from Mr. Severn, our Consul at Rome, by Earl Russell, then Secretary of State for Foreign Affairs, and was communicated by him to the College.

It gave an account of 'an extraordinary gathering in of the Roman harvest in the Campagna.'

Previously 'it had always been collected by the Abbruzzi peasants, who, tempted by high wages, risked health, and even life, in this perilous work.' The harvest takes place just at the commencement of the malaria season; and no Romans ever work in it. The usual consequences were 'thousands annually in the Roman hospitals,'—while this year there was none. By some wise arrangement of the Turin Government—a new railroad to Pescara having probably some influence—no Abbruzzi peasants arrived. Either they demanded too large a sum for the farmers to pay, or work was provided for them at home. The ministers were therefore obliged to send the Papal troops, and General Montebello permitted the French troops also, to assist in getting in the harvest. No fevers consequent upon this dangerous harvest-labour had been heard of.

Mr. Severn attributed—rightly no doubt—this exemption from disease on the part of the soldiers to the fact that they were well provided with good food and wine; whereas the Abbruzzi people, as he had himself witnessed, drank during the harvest nothing but water (containing possibly the malaria poison), and had little else than water-melons for food.

It was calculated that not more than one-third of them ever returned from the harvest.

The practical lesson to be derived from a knowledge of this fact is too obvious to dwell upon. In malarious countries the open air at night must be avoided. 'Early to bed' is always a good and wholesome rule; but the other half of the proverb 'early to rise' becomes in such countries an unsafe precept. At least it is hazardous to *leave the house* early.

Secondly, the malaria *loves the ground*. It tends downwards. Whether this results from its specific gravity; or from its adhering to the moisture suspended in the lower strata of the atmosphere; or from some peculiar attraction for the earth's surface, I cannot tell you. There is reason to suppose that the poison combines somehow, or becomes entangled, with fog: and fogs usually settle and brood, at night especially, upon the surface. This may be one reason why *lying down* to sleep in the open air at night is so very perilous; and why the *indormientes* suffer more than the *vigilantes*. The lower rooms of the same house may contain the noxious effluvia, while the upper are free. 'In all malarious seasons and countries,' says Dr. Ferguson, 'the inhabitants of *ground floors* are uniformly affected in a greater proportion than those of the upper stories. According to official returns during the last sickly season at Barbadoes, the proportion of those taken ill with fever in the lower apartments of the barracks exceeded that of the upper by one-third, throughout the whole course of the epidemic. At the same time it was observed that the deep ditches of the forts, even though they contained no water—and still more the deep ravines of rivers and water-courses—abounded with the malarious poison.' Dr. Hunter, in his work on the diseases of the army in Jamaica, says, 'The barracks of Spanish Town consist of two floors, the first upon the ground, the second on the first. The difference in the health of the men on the two floors was so striking as to engage the attention of the Assembly of the island: and upon investigation it appeared that *three* were taken ill on the ground floor, for *one* on the other. The ground floor was not therefore used as a barrack afterwards.' Mr.

Ralph, in a table printed as an appendix to a paper of Dr. Ferguson's in the eighth volume of the 'Medico-Chirurgical Transactions,' states the results of an inquiry into the comparative healthfulness of the upper and lower apartments of barracks in Barbadoes, to have been that the individuals residing in the lower apartments were attacked in the proportion of two to one of those living in the upper: and with certain apparent exceptions, which I shall notice presently, experience is uniformly in favour of the proposition that the poison is most prevalent and destructive near the surface of the earth, and does not rise high into the atmosphere.

To specify the sanitary precautions dictated by an acquaintance with this property of the malaria, must be quite superfluous.

Thirdly, the malaria is *moveable by the wind.* It is capable, therefore, of being carried *from* the spot where it was generated; and *to* other places which might else be free from it, and healthy. In this respect it is analogous to a heavy fog or vapour; and, in some cases, it is accompanied by a palpable mist; to which, perhaps, it may cling. The following passage relative to this subject occurs in Bishop Heber's 'Journal.' 'From Cheeta Talao our road lay through a deep and close forest, in the lower parts of which, even in the present season, the same thick milky vapour was hovering as that which I saw in the Terrai, and which is called *essence of owl.*' This Terrai is the region which I mentioned in the last lecture as being so pestiferous, that it is deserted, during certain parts of the year, by every living creature.

This conveyance of the poison, like a cloud or fog, from one part of the surface of the ground to another, it is very important to attend to in all places; and especially so in tropical climates, where the wind blows for a long time together from the same quarter. We are thus enabled to account for the apparent exceptions to the last-mentioned property of the malaria, viz., its preference of low to elevated situations. You will readily understand how the miasmata may roll up, and hang accumulated upon, the side of a hill towards which a current of air sets steadily from or across a neighbouring marsh. Nay, the poison may be thus blown *over* a hill, and deposited on the other side of it. In this way, I presume, are to be explained the following curious facts, related in Dr. Ferguson's paper.

'The beautiful port of Prince Rupert's, in the island of Dominica, is a peninsula which comprehends two hills of a remarkable form, joined to the main land by a flat and very marshy square isthmus *to windward*, of about three quarters of a mile in extent. The two hills jut right out on the same line into the sea, by which they are on three sides encompassed. The inner hill, of a slender pyramidal form, rises from a narrow base nearly perpendicular, above and across the marsh from sea to sea, so as completely to shut it out from the port. The outer hill is a round-backed bluff promontory, which breaks off abruptly in the manner of a precipice above the sea. Between the hills runs a very narrow clean valley, where all the establishments of the garrison were originally placed; the whole space within the peninsula being the driest, the cleanest, and the healthiest surface conceivable. It was speedily found that the barracks in the valley were very unhealthy; and to remedy this fault, advantage was taken of a recess or platform near the top of the inner hill, to construct a barrack which was completely concealed by the crest of the hill from the view of the marsh on the outside, and at least three hundred feet above it: but it proved to be pestiferous beyond belief. In fact no white man could possibly live there, and it was obliged to be abandoned. At the time this was going on, it was discovered that a quarter which had been built on the outer hill, on nearly the same line of elevation, and exactly five hundred yards further removed from the swamp, was perfectly healthy; not a single case of fever having occurred in it from the time it was built.'

There is a striking anecdote given by Lancisi, showing, on a small scale, the effect of the wind in carrying the malaria with it. Thirty ladies and gentlemen had sailed to the mouth of the Tiber on an excursion of pleasure. Suddenly the breeze shifted to the south, and began to blow over a marshy tract of land situated to windward of them. Twenty-nine of the thirty were immediately after attacked with tertian ague. So also Humboldt informs us that the town of Cariaco is afflicted with intermittents by the north-west wind conveying across it the miasmatic emanations of the Laguna of Campona.

And as the wind may thus transport the malaria to a distance, and thereby render a spot unhealthy which naturally might be salubrious, so also it is often of service in clearing the poison from other places, and preventing its concentration.

A knowledge of these facts ought to be valuable in determining the choice of encampments, and of sites for dwelling-houses in aguish districts. Settlers in hot climates, especially where trade-winds prevail, would do well to avoid founding towns on the lee side of any swampy or suspicious ground. The outlets of rivers are commonly selected, for the convenience of commerce: and there is often a right and a wrong bank. I believe that most of the principal towns in the West Indies are built, for the advantage of the outward bound vessels, upon the western, or lee side of the islands.

Fourthly, it is a singular, but well-ascertained fact, that the miasmata lose their noxious properties *by passing over even a small surface of water.* Probably they are absorbed by it. And this is another mark of their tendency downwards. Many instances have already been referred to, where some of the crew of a ship have landed on a malarious coast, and have all been attacked by the fever; while the rest of the sailors, who remained on board, continued all healthy and well, though the ship was close to the shore. You could not have a better or more striking example of this than what took place at Walcheren. 'Not only the crews of the ships in the road of Flushing were entirely free from the endemic; but also the guard-ships which were stationed in the narrow channel between this island (Walcheren) and Beveland. The width of this channel is about six thousand feet, yet, though some of the ships lay much nearer to one shore than to the other, there was no instance of any of the men or officers being taken ill with the same disorder as that with which the troops on shore were affected.' This Sir Gilbert Blane has told us; and it is curious that Sir John Pringle made the very same remark in the very same place in 1747. He is speaking of the diseases of the campaign in Dutch Brabant: especially in reference to four battalions which had remained for some time in Zealand: and he says:—'But Commodore Mitchell's squadron, which lay all this time at anchor in the channel between South Beveland and the island of Walcheren, in both which places the distemper raged, was neither afflicted with the fever nor the flux, but amidst all that sickness enjoyed perfect health; a proof that the moist and putrid air of the marshes was dissipated, or corrected, before it could reach them.'

It is probable that this peculiarity has led to an erroneous and contracted estimate of the space through which the poisonous effluvia may be wafted, upon land, by the wind. Although the distance to which they are capable of being so conveyed, without losing their morbific power, has never been precisely defined, there can be no doubt that it is considerable. In Italy, according to Dr. Macculloch, the poisonous exhalations of the lake Agnano have been ascertained to reach as far as the convent of Camaldoli, situate on a high hill three miles distant.

I say the miasmata may probably be absorbed by the water over which they pass, or hang; and this reminds me of an opinion entertained by some writers, that the fever may be caused by drinking such water. The following interesting facts, suggestive of this notion, are recorded by Mr. Grainger in his Report on the Cholera of 1848–49.

Dr. and Mrs. Evans, of Bedford, were both attacked with ague while staying at Versailles in the year 1845. The water used there for domestic purposes is brought from the Seine at Marli. A large tank in which it was collected for distribution to a particular quarter happened at that time to be damaged; and the mayor of the place provided a new supply of water, consisting of the surface drainage of the surrounding country, which is marshy. This water the inhabitants of Versailles would not drink; but Dr. and Mrs. Evans, living at an hotel, drank of it unwittingly. It was made use of by a regiment of cavalry also. The result was, that they who drank the water suffered intermittent fever of so severe a type that seven or eight of the soldiers died of it in one day. Upon careful investigation it was ascertained that those only of the troops were attacked who had drunk the marsh water; all the rest, as well as the townspeople, having escaped, though all of them breathed the same atmosphere.

He quotes another instance from M. Boudin. 'In July, 1834, 300 soldiers, all in good health, embarked on the same day in three transports at Bona, and arrived together at Marseilles. They were all exposed to the same atmospheric influences, and, with one essential difference, supplied with the same food, and subjected to the same discipline. On board one of the vessels were 120 soldiers. Of these, 13 died of a destructive fever during the voyage, and 88 more were taken to the Military Hospital of the lazaretto at Marseilles, presenting all the pathological characters proper to marshy situations. It appeared upon inquiry that the water furnished to the soldiers on board the affected ship had been taken, in the hurry of embarkation, from a marshy place near Bona, while the crew, not one of whom was attacked, were provided with wholesome water. It was further ascertained that the nine soldiers who escaped the disease had purchased water from the crew, and had not partaken of the marsh water. Not a single soldier or sailor suffered in the other transports, which were supplied with pure water.'

Dr. Snow, who refers to these statements in his interesting volume on cholera, cites this additional evidence to the same purpose from the 'Report of the Poor Law Commissioners on the Sanitary Condition of Great Britain.' 'Mr. William Blower, surgeon, of Bedford, states that typhus and ague, which had long infested the village of Wooton, near Bedford, has been much diminished by digging a few wells, and obtaining good water. He states, also, that in the neighbouring parish of Houghton, almost the only family which escaped ague at one time, was that of a respectable farmer who used well water, while all the other families had ditch-water only.'

This theory, even if its truth be conceded, of the occasional conveyance of the ague poison into the stomach by means of water as a drink, is by no means inconsistent with the belief that it most commonly operates through the medium of the atmosphere, and enters the body with the breath. We shall meet with facts which tend to strengthen the presumption in favour of the theory, when we come to the consideration of *cholera* as a disease.

Fifthly, another remarkable property of the marsh poison is its attraction towards, and its adherence to, the foliage of lofty umbrageous *trees*; so that it is very dangerous, in malarious places, to go under large thick trees, and still more dangerous to sleep under them. But this property, thus a source of peril to those who are ignorant of it, affords when known and rightly made use of, a mode of protection and remedy against the influence of the miasmata. In the territory of Guiana, where large trees abound, the settlers live fearlessly, and unhurt, close to the most pestiferous marshes, and to leeward of them, provided that a screen or belt of trees be interposed. New Amsterdam, in Berbice, lies on the lee side of an immense swampy forest, in the direct track of a strong trade-wind that blows night and day, and pollutes even the sleeping apartments of the town with the stench of the marshes; yet it brings no fevers. The inhabitants are well aware that it would be almost certain death for a European to sleep, or even to remain after nightfall, within the verge of the forest. To cut down the trees would not only be a perilous operation in itself; but would let in pestilence upon the town.

This property also of the malaria, as well as the use to which it may be turned, was known to Lancisi. He describes the vast increase of agues and remittent fevers in Rome during the summer of 1695, after a great overflowing of the Tiber, by which the lower part of the city, and the fields adjacent, had been inundated in the preceding winter. The bad effects of this flood were felt throughout the whole of Rome, with the exception of one particular quarter, which was protected by a belt of trees around it. Lancisi even addressed a remonstrance to the Pope against a project which was entertained of felling some wood near the Pontine marshes, between them and the city. He endeavours to show that woods and groves were first made sacred, on account of their conservative influence in this way, to prevent their ever being cut down.

It would appear, from the facts I have just been detailing, that dwellings unfortunately built in the vicinity of marshes, might sometimes be rendered salubrious and safe by encircling them at a little distance by a hedge of trees—or (perhaps) even by drawing round them a broad moat of water. Such expedients deserve, at least, a fair trial.

Sixthly, the generation and consequently the effects, of the malaria are prevented, or lessened, by culture of the soil. It is to this, that the diminution of agues in this country is mainly attributable. The fenny lands have been drained; and much of them brought under the plough. Dr. Craigie states that East Lothian, in Scotland, was at one time so productive of malaria, that for the reapers in harvest to be attacked with ague was quite a thing expected; but that now, in consequence of the perfect tillage, and the numerous tracts of wood with which the country is covered, the disorder is quite unknown there. Conversely, in regions which have been suffered to fall out of cultivation, intermittent and remittent fevers multiply. The more thoroughly any country is cultivated, the more fully, in general, is it *peopled* also: and in many places the prevalence of these fevers has been observed to diminish and increase with the increase and diminution of the population. *Cœteris paribus*, agues are much less common in large towns than in country villages. This has been oddly enough accounted for by saying that populous cities are so full that there is no room for the malaria. A much more rational and probable explanation is that which attributes the freedom of crowded towns, and thickly inhabited districts, to the prevalence of drainage in them.

Many instances might be adduced to show that the more any place, naturally producing malaria, is depopulated, the more evident does the power of the poison become. The Italians date the introduction of the malaria into the Maremma, from the great plague in the sixteenth century, since which period the inhabitants of that district have never been sufficiently numerous to counteract the bad air, which increases as population and agriculture diminish.

Bishop Heber, in the narrative I quoted before, bears testimony to facts of the same kind with those I have now been stating. He says, 'At the foot of the lowest hills, a long black level line extends, so black and level, that it might seem to have been drawn with ink and a ruler. This is the forest, from which we are still removed several coss, though the country already begins to partake of its insalubrity. It is remarkable that this insalubrity is said to have greatly increased in the last fifteen years. Before that time, Ruderpoor, where now the soldiers and servants of the Police Thanna die off so fast that they can scarcely keep up the establishment, was a large and wealthy place, inhabited all the year through, without danger or disease. The unfavourable change is imputed by the natives themselves to depopulation. The depopulation of these countries arose from the invasion of Meer Khân, in 1805. He then laid waste all these Pergunnahs, and the population, once so checked, has never recovered itself.'

When persons having intermittent fever are unable to leave the unhealthy situation in which they have been exposed to the influence of the malaria—and especially when they are placed under unfavourable circumstances in respect of food, clothing, and shelter—the disease is apt to become exceedingly serious, leading to disorder of the sensorium, and great disturbance of the abdominal viscera, even in the intermissions; sickness, diarrhœa, dysentery, diseases of the liver. In Zealand, the biliary functions suffer so much during the complaint, that it is commonly known among the inhabitants of that country under the name of the *gall fever*. The frequent unnatural concentration of the blood in the internal parts may afford a reasonable explanation of these phenomena. When death takes place, morbid appearances present themselves such as might be expected: hepatic alterations; inflammation and ulceration of the mucous membrane of the alimentary canal: but the most characteristic morbid condition produced by repeated attacks of intermittent fever consists in enlargement of the *spleen*; with or without induration of its substance. That viscus is sometimes enormously increased in bulk, so as to be *felt*, and even its outline *seen* through the integuments of the abdomen. It has been known to weigh nearly eleven pounds. So common is this state of the spleen that it is familiar to the observation of the vulgar, who have even given it a name; it is called among the inhabitants of the fenny parts of this country, the *ague cake*. I believe that whenever the abdominal circulation is much embarrassed, and the abdominal veins gorged, as they must be during the cold stage of an intermittent, the spleen in particular becomes distended with blood. Constantly we see this happen when the passage of the blood through the portal vessels is impeded by disease of the liver. Dr. Murchison tells us, in fact, that in the intermittent fevers which he witnessed in Burmah, the spleen, 'in almost every instance in which it was carefully examined by means of percussion, was found to be considerably enlarged during the paroxysms, the enlargement subsiding spontaneously during the intermissions, whether quinine was administered or not.' Now this enlargement or distension may not always subside thoroughly. If the paroxysms of ague be frequently repeated, we may understand how the spleen may become fuller of blood on each successive occasion. It may be that a portion of the blood coagulates; or that inflammation of a slow kind is set up in the stretched covering of that organ. At all events, this is a very common sequel of ague: and it can scarcely be doubted that the repeated congestions of the internal vessels and viscera are the determining causes of the ague cake.

Independently of the paroxysms of ague, there is ample evidence to show the injurious influence of the malarious districts upon the general health. In this country such effects are not much seen; but in places where the malaria is more constantly and abundantly present, the race of inhabitants deteriorates. Their stature is small; their complexion sallow and yellowish; they are prematurely old and wrinkled; even the children early acquire an aged aspect; and the spirits and intellects of those who dwell in these unhealthy spots are low and feeble, and partake of the degeneration of their bodily qualities.

It is therefore strange that a notion should ever have prevailed, of the *salutiferous* effects of an attack of ague. But such a notion may be traced from very nearly our own times up to the earliest records of physic. The late Dr. James Sims, who was a physician of some note in this town, felt convinced, at the commencement of the illness which terminated his life, that he should recover if he could catch an ague: and he went down into one of the marshy districts expressly for that purpose; but returned to London without having succeeded, complaining that the country had been spoiled by draining, and that there were no agues to catch. The superstitious Louis XI. entertained a similar opinion, and prayed to the Lady of Selles that she would confer upon him a quartan ague. *Our* monarch, James the First, had more sensible notions on that score. There is an old English proverb which says, 'An ague in the spring, is physic for a king;' and when this was repeated to him by his courtiers, he, being then ill of that disease, answered that the adage might be applicable to a young man, but that it would not do for an old one like him. In fact, as I mentioned before, he died of his ague. The same doctrine has, however, been handed down to us by the father of physic himself. Hippocrates says, in the fifty-seventh Aphorism of his fourth Section, *ὑπὸ σπασμοῦ, ἢ τετάνου ἐνοχλουμένῳ, πυρετὸς ἐπιγενομένος λύει τὸ νούσημα.* And Celsus, in his capital digest of the medical knowledge of his time, preserves the same opinion, with some apparent astonishment that it should be true. 'Denique ipsa febris, quod maxime mirum videri potest, sæpe præsidio est.' I recollect hearing Dr. Graham, the professor of botany in Edinburgh, relate the following anecdote in one of his clinical lectures:—His brother was intimate with the professor of natural history at Cremona; and this gentleman was resolved to put the truth of the aphorism that I have quoted from Hippocrates to the test. Accordingly he sent a patient afflicted with *epilepsy*, to pass a night or two in a marshy place, where the malaria was known to be so abundant, and so powerful, that few escaped ague, who were there exposed to its influence; and the two-fold design succeeded admirably. The patient got an ague, and lost his epilepsy. The worthy professor contented himself with moderating and keeping in check the new complaint, thus intentionally produced, for a period of six months, when he administered its *coup de grâce* in a few doses of Peruvian bark; and the epilepsy never returned. If I had believed that this could have been anything more than a mere coincidence, I should have told you of it before, when I was speaking of the treatment of epilepsy.* I should rather imagine the notion thus prevalent for so long a time, that ague had a salutary tendency, and that it was wrong to stop it too soon, to have originated in the difficulty which physicians found in stopping it, before its cause was so well understood, and the specific for it was discovered. They found it obstinate under the feeble and inert methods then employed, and therefore they endeavoured to persuade their patients, and perhaps themselves also, that the disease had better proceed a certain length.

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* "A medical officer in India became subject to epileptic attacks, which resisted treatment. It was feared that he had become a confirmed epileptic. He was attacked by intermittent fever, which affected him at intervals for many years; but from the date of his first paroxysm of ague he never had another

I have very little to say, in addition to what you must have inferred from what I have already said, as to the *prognosis* in intermittent fevers. In cold countries, such as ours, it is almost always favourable. Of course it will be modified by the previous condition of the patient: if he were beforehand the subject of serious organic visceral disease; or if he be very old or infirm; the supervention of ague may destroy him. But to persons of tolerable health and strength prior to the setting in of the ague, we may confidently promise a *cure*. In warm countries intermittent fevers are much more dangerous: and are sometimes very rapidly fatal. They are often accompanied by most severe affections of the head, stupor, delirium, convulsions; and of the alimentary canal, diarrhœa, sickness, and not unfrequently the black vomit. They are prone also, in those climates, to run into the remittent or continued form; and this tendency is shown by long protracted paroxysms, or by the anticipation or doubling of the paroxysms. In all countries quartans are cured with more difficulty than either tertians or quotidians. And quartans are most common in the autumn: and accordingly autumnal intermittents are more pernicious and intractable than the vernal. This fact has passed into a proverb in Italy; which proverb has been thus translated into Latin, 'Febris autumnalis vel est *longa*, vel *lethalis*.' The longer intermittents have lasted, the more difficult also are they to cure; and certainly there is much more danger of *visceral disease* in those that are of long standing.

It is probable that agues, such as we see in this country, would generally, under favourable circumstances, terminate in spontaneous recovery, provided that the patient could be put beyond the further operation of the malaria, protected from exposure to wet and cold, and suitably nourished. But possessing as we do a specific cure for ague, there would be no sense

epileptic attack. I knew this officer in India well. The fits of epilepsy were genuine, and the attacks severe and frequent."—Dr. Maclean, in Reynold's *System of Medicine*.

in our allowing the experiment of a spontaneous recovery to be made: or rather we should be inexcusable, knowing as we do that the complaint is the more obstinate the longer it has lasted, and that it tends to the establishment of organic visceral disease, we should be without excuse if we did not stop it as quickly as we can. The disease is always distressing to the patient, and always debilitating. It may be dangerous, even in these climates, to weak or old persons: and it is dangerous to all persons in hot climates. 'If the first fit (says the wise and observant Heberden) has been marked so clearly as to leave no doubt of its being a genuine intermittent, the remedy should be immediately given in such a manner as to prevent, if possible, a second.' There needs very little preparation of the patient before administering the specific substance which is to cure him; and which every one here knows, before he hears me say so, to be the celebrated Peruvian bark, or its active principle as presented by the salts of quina. The old practice was to wait a few returns of the fits, either till some hypothetical ferment had taken place, or until supposed morbid matter had been expelled by vomiting or purging. There is, however, one very simple and short preparative which I am in the habit of using, and which I learned at Cambridge. You are aware that Cambridge is situated on the very edge of the fenny country which extends along that part of the east coast of the island. Numerous patients afflicted with ague come in from the surrounding villages; and Dr. Haviland found that many of these had taken quina before they applied for assistance as out-patients at the hospital: but with very poor success. Now these cases readily gave way—the patient remaining in all other circumstances as before—after the operation of a calomel purge. I have adopted this practice, therefore, upon his recommendation; but it does not delay the specific treatment. I generally prescribe three grains of calomel with six or eight grains of rhubarb at bed-time, and commence with the quina the next morning. Very lately, in perusing the late Dr. Baillie's posthumous volume, I met with the following passage:—'I have known a good many cases in which bark alone would not cure an ague. In all these cases, as far as I now recollect, when a grain of calomel was given every night for eight or ten nights, bark cured the ague in the course of a few days. This practice I learnt from my friend Dr. David Pitcairn.'

I believe that calomel given once in a purgative dose is enough.

But first of all what is to be done for the patient while he is *in* the fit? I confess to you that I seldom give myself much concern on that head. In ague, as we see it in this country, nature generally prompts the patient what to do: to cover himself up in bed, to apply warmth to his feet, and to take some hot drink, during the rigors; to adopt a cooler regimen during the hot stage; to wipe the skin dry, if the sweating should be very profuse or protracted. But in hot countries, and in severer forms of intermittent, the patient really requires some help; and therefore I must consider shortly in the next lecture the management of the paroxysm; and I am the more bound to do so, because certain measures which I do not think necessary or judicious, at any rate for the complaint as we see it here, have lately been strongly recommended for adoption during the ague fit.

LECTURE XXXVII.

Treatment of Intermittent Fever; during the paroxysm; during the intermissions. Prophylaxis.

I WAS about, when we last separated, to consider the treatment of ague: first, during the paroxysms; secondly, during the intermissions.

In this climate we need not, I say, encumber with too much help a patient in an ague-fit. But in hot countries, where the disorder is apt to run into the remittent, or even the continued form, and where, during its violent and rapid course, internal organs are liable to sustain serious damage, the best and indeed almost the only time for the effectual interference of the physician is in the first assault or paroxysm of the disease.

The objects of treatment during the paroxysm are, to alleviate the uneasy sensations of the patient; to abridge, if possible, their duration by shortening the fit; to avert the danger which, under certain circumstances, may arise from intense internal congestion long continued, or from the severity of particular symptoms; and to prevent the recurrence of the paroxysm.

Now in the cold stage of ague, *diluent drinks* have been recommended, and *cordials*, and *external warmth*, and *opium*, and *emetics*, and *blood-letting*. One would suppose that if some of these expedients were useful, others could scarcely be so too. The *diluent drinks* are very proper: and I should allow the patient to follow his own inclination in the choice of them. It was the custom formerly, to prescribe medicated drinks of this kind; and one pleasant, but neglected ptisan, the *decoctum hordei compositum*, long lingered in our Pharmacopœia. Nowadays we are contented with the simple barley-water, toast and water, weak tea, gruel, and the like. These diluents should be taken warm, and for persons who are very feeble or exhausted, they may be made gently *cordial*; weak negus, for example, or white wine whey, may be given.

External warmth, being what nature and common sense would suggest, is certainly advisable and beneficial in the cold fit; even the warm bath, if it can be procured. In some places it is the custom to await an expected fit *in* the warm bath. When this cannot so conveniently be obtained, the pediluvium may be employed; or the patient may be put into a warm bed, and have bags of hot salt or bran applied to his epigastrium; and a hot bottle, or a hot brick, wrapped up in flannel, to his feet. Or, what perhaps, is best of all, he may have a hot-air bath *applied to him*, as he lies in bed. This may be very easily done by means of a half-cylinder or cradle of wicker work, closed at one extremity by a board. This is laid over the patient, and then covered with blankets. Through a hole in the centre of the board, one end of a curved iron tube is passed; the other end, expanded into a bell, looks downwards; and a spirit lamp being placed beneath it, the air between the wicker work and the sick person is soon made very hot. This apparatus was constructed many years ago, by Dr. Gower, when he was physician to the Middlesex Hospital; where its utility has been fully proved. External warmth applied in some one of these ways, affords singular comfort oftentimes, and contributes to shorten the cold stage. And the same may be said of friction, with stimulating liniments, along the course of the spine. Lind found that, in children, rubbing the spine with an embrocation composed of equal parts of soap liniment and laudanum, at the approach of the cold stage, often prevented the paroxysm.

Opium has often been given in the cold stage, with the view of cutting short the fit; and not without some success. The strongest evidence of its usefulness in that stage of the paroxysm is furnished by Dr. Trotter, in his 'Medicina Nautica.' Agues being very frequent among the crew of the Vengeance, he resolved to try the full effect of opium in preventing the fit. At its first approach a dose of laudanum (never less than thirty drops) was given: if this did not bring on some warmth within ten or fifteen minutes, from twelve to twenty drops more were administered. In most cases, 'in a few minutes an exhilaration of spirits was perceived: the pulse from being weak, quick, and sometimes irregular, became full, less frequent, and equal; an agreeable warmth was diffused over the whole frame, and every unpleasant feeling vanished, sometimes in a quarter of an hour. The patients were themselves surprised at the sudden change in their sensations.' Dr. Trotter speaks of these as being the completest cures that ever came under his observation. If, at the next period, the paroxysm threatened to recur, the opiate was repeated always with the same success. 'Few instances were met with where any indisposition indicated a third attack, at the expected period of accession.' Notwithstanding this testimony, it appears that opium is still better adapted to another stage of the paroxysm.

Emetics were formerly much prescribed in the cold stage, at its earliest approach. Cullen recommends them; and they may sometimes be useful, in spite of Chomel's assertion that they are always hurtful. That they have gone so much out of fashion is, however, a proof that they cannot be depended upon for cutting short the paroxysm. Vomiting itself is no small distress to many persons; and, for my own part, I should not think of giving an emetic unless some indications of a loaded and oppressed state of the stomach were present; such as nausea, an ill taste in the mouth, a coated tongue, and foul breath. A scruple of ipecacuan will, even then, be sufficient. The object is to empty the stomach effectually but mildly. I would not give antimony. Irritability of the stomach, in the more violent of these fevers, is too apt to arise spontaneously. Sir Gilbert Blane tells us that the greatest impediment to the cure of the severer intermittents at Walcheren, in their early stages, proceeded from the extreme irritability of the stomach, which made it difficult to administer the requisite medicines. In hotter climates nausea and vomiting are still more common and more urgent; and we have to guard against the risk of inducing or aggravating these symptoms. 'Emetics (says Dr. Mackintosh, in his 'Practice of Physic') have been often extolled, but I believe every experienced tropical physician will agree with me in cautioning young practitioners against their indiscriminate employment. Irritability of the stomach is one of the most frequent and troublesome symptoms; and once excited, it is always difficult, and in many cases impossible, to restrain it. I have seen emetics exhibited, and the vomiting has continued till death, in spite of every remedy.'

Lately, the practice of *venæsection* in the cold stage has been revived (for it is not a new practice), and strongly recommended, by the physician whose name I have just mentioned; and whose opinion carries with it the more weight from its having been founded on much personal experience in the treatment of these fevers. Dr. Mackintosh affirms that bleeding, performed in the cold stage, will often stop at once the paroxysm, and with it the disease: that even when its curative effects are less decisive, it will generally stop the cold stage, and shorten the paroxysm, and mitigate its severity, and afford speedy and great ease to the distressful sensations of the patient; and that any subsequent paroxysms which may occur will be mild and few. One bleeding, he says, is commonly sufficient: sometimes two are required; seldom more than two. The blood is to be suffered to flow till the patient feels relief: which usually consists in liberation from pain of the head and loins; freedom of respiration; the departure of the painful sensation of cold; and the cessation of the tremors and of the debility. Most of the patients fall asleep after the operation. These effects have been produced by the abstraction of an ounce and a half of blood; they have sometimes (but rarely) required for their production twenty ounces.

Now this is the piece of practice to which I adverted at the close of yesterday's lecture, as being, in my humble opinion, inexpedient, and not to be recommended; at least in the agues of this country. I have seen a good many cases, first and last, and certainly I have never seen one in which I could have thought such a heroic remedy necessary, in the cold stage; if indeed it be, in that stage, a remedy at all. But I do not desire to oppose my experience alone, or my judgment, to those of Dr. Mackintosh. His method has been tried, since he first made it public, by various practitioners in this country. Drs. Townsend and Law, of Dublin, found it fail in the majority of cases. In Dr. Stokes's hands, the most usual effect of blood-letting in the cold stage was, to check the shivering; and, next to this, to mitigate its severity, without abridging its duration. In most instances, no modification was produced of the hot or of the sweating stages. In Dr. Kelly's experience, the general effect was, to shorten the cold stage, and to render the hot one milder; but in some cases it seemed to aggravate the symptoms. Mr. Gill found that, although the blood-letting might cut short the cold stage, it appeared to lengthen the period of febrile disturbance.

Confining myself, then, to intermittents as they show themselves in this climate, I cannot advise you to adopt the practice introduced by Dr. Mackintosh—of bleeding in the cold stage. I object to it because it appears to me quite unnecessary; because it is not such as the nature of the symptoms would suggest; because it tends to produce subsequent debility, which we should not needlessly inflict; and because the experience of other sober-minded men, who have given the method a fair trial, does not bear out the statements made by Dr. Mackintosh in respect of its usefulness.

At the same time, after a careful perusal of nearly a hundred cases adduced by Dr. Mackintosh to illustrate the efficacy of this measure, I think it highly probable that blood-letting may constitute a most important part of the treatment, in the very outset of the severer malarious fevers of hot climates; attended as they are with a degree of internal congestion and disturbance which is dangerous to the integrity of vital organs.

If, in this country, bleeding be requisite at all, it is in the *hot* stage. But it is not requisite at all, except when there appears to be danger of some internal inflammation. The best remedy of the hot stage is undoubtedly opium. Dr. Lind, who wrote after large experience, says that he never saw a person die in the cold fit, but had known several carried off in the hot one, with strong convulsions and delirium. He happened to notice the beneficial effect of an opiate given while the patient was very hot and feverish. He determined therefore to make further trial of opium in the paroxysm. 'Having at that time (says he) twenty-five patients labouring under intermittent fevers, I prescribed an opiate for each of them, to be taken *immediately after* the hot fit, provided the patient had then any inquietude, headache, or any such symptom usually subsequent to the fever. The consequence was, that nineteen in twenty-two received immediate relief; the other three had no occasion to take it.

'Encouraged by this surprising success, I next day ordered the opium to be given *during* the hot fit. In eleven patients out of twelve to whom it was thus administered, it removed the headache, abated the fever, and produced a profuse sweat; which was soon followed by a perfect intermission. Since that time I have prescribed an opiate to upwards of three hundred patients labouring under this disease: and I observed, that if taken during the intermission, it had not the least effect, either in preventing or mitigating the succeeding fit; when given in the cold fit, it once or twice seemed to remove it; but when given half an hour after the commencement of the hot fit, it generally gave immediate relief.'

Dr. Lind goes on to state that he found the influence of opium more uniform and constant in intermittent fever than in any other disease; and more quick and sensible than that of any other medicine.

Very little need be said in regard to the sweating stage. Up to a certain point the perspiration is to be promoted and encouraged. When the uneasy feelings of the patient have abated, it should be restrained; not suddenly, but with caution. Now the sweating may be promoted by diluents; by keeping the patient in bed, and covered with moderately warm clothes; by sippings of hot gruel, or of hot chicken broth. On the other hand, when the sweating has continued long enough, it may be stopped by drying the patient carefully with towels, changing his linen, and getting him up, out of bed.

It is well to bear all this in mind; but I repeat once more that in agues, such as you are likely to meet with in this country, it is unnecessary, and therefore objectionable, to be *over-busy* during the paroxysm. In hot climates, however, as I shall further explain presently, the early portion of the sweating stage has been found the most eligible time for the energetic use of the great specific antidote to the disease.

There are certain general remedies, the adoption of which has been recommended during the intermissions; and there are certain remedies deemed specific. The general remedies are bleeding, emetics, and purgatives. They need not detain us a moment. Local blood-letting may be used if there be any apparent tendency to local inflammation, or any marks of severe topical congestion; especially in young and robust subjects. Barring such circumstances, there can be no occasion to bleed your patient in the intermissions.

An emetic given a short time before the expected paroxysm has been known to prevent its accession; and even has sometimes cured the disease. But we can stop the paroxysms by gentler and better means; so that I should not prescribe an emetic unless I saw symptoms of a foul and loaded stomach.

Purgatives should always be given at the outset. They clear the stomach and intestines of hurtful accumulations, which are apt to impede the beneficial operation of the quina, or of other drugs given to check the disorder. I mentioned in the last lecture my own custom in this matter; viz., to give a couple or three grains of calomel with eight or ten of rhubarb at bed-time; and to commence with the specific remedies the next day.

Of these specific remedies, *bark* and *arsenic* are by far the most certain and important; but a multitude of others have been highly praised for possessing similar virtues. I shall by and by say a word or two about *some* of these, because bark is dear, and arsenic is scarcely a safe drug to be entrusted to the hands of unprofessional persons; and yet it is often expedient, in country places, where agues are rife, to provide the poor with remedies which they may have at hand; and which should both be reasonably cheap, and perfectly safe.

I shall not detain you with any account of the difficulties and objections which were thrown in the way of the *Peruvian bark*, upon its introduction into the materia medica about the middle of the seventeenth century. Its use met with the most violent opposition, even from physicians of the highest authority. It was resisted by Stahl and Hoffman; and Boerhaave was never quite reconciled to it. Sydenham, by his example and recommendation, greatly promoted its adoption in this country. All this history is sufficiently curious and interesting, but I have no time for it: and you will doubtless hear it from one of my colleagues. I will merely say that in the Peruvian bark we have one of the very few *specifics* that we can boast of possessing: and that, unlike most other highly vaunted substances, so far from falling off from the accounts first given of its virtues, it has acquired in the lapse of time an increase and stability of reputation.

Neither shall I enter at all into the consideration of the qualities of the several species of cinchona; nor of the several principles that may be educed from them; nor of the modes in which the quina even may be best procured. This would not belong legitimately to my province. I must suppose that the Professors of chemistry and of materia medica have furnished you with the sulphate of quina, which is the only preparation of the bark I intend particularly to notice: and *my* business is to tell you what I know in respect of its employment as a *remedy for ague.*

I may observe, however, that this is a remedy to which we could never have been led by any process of reasoning. It is a matter of pure empiricism. We know nothing of the seat or of the essential nature of the disease; we are equally in the dark as to the *modus operandi* of the quina in curing it; yet our knowledge of ague, upon the whole, estimated in reference to its precision and practical bearing, is more satisfactory than of many other complaints, with the seat and nature of which we are much better acquainted. The group of symptoms is so distinct, that we have no trouble or doubt as to the diagnosis; and experience has taught us a remedy which is all but infallible.

The discovery of quina and its salts formed a great era in the history of the materia medica. As far as my own experience goes, the sulphate of quina has quite superseded the need of any other form of cinchona for the cure of ague. Before quina was unshrouded by the chemist, the bark in substance was the only form in which the remedy could be confidently relied upon; and I am old enough to be aware of the infinite superiority of the salt over the actual bark. To obtain the desired effect, it was often necessary to give this in such quantities as almost justified Mr. Abernethy's sarcastic way of speaking of it and of physicians. He said the doctors talked of throwing in the bark, as if it were to be pitched into the stomach with a shovel. The sulphate of quina lies in a much smaller compass, and a more commodious form; and it does not cause that insupportable nausea which the woody mass of the powdered bark was so apt to occasion.

I have been in the habit of giving two, and sometimes three, grains of the sulphate of quina every four or six hours during the intermissions, to those patients whom I have had occasion to treat for ague. This plan has succeeded so well, that I have never been tempted to try any other. I may, indeed, say that I have scarcely ever known it fail to stop an ague; and to stop it speedily: so that very few paroxysms have occurred after the patient has begun to take the medicine. I commonly prescribe twice as many drops of dilute sulphuric acid as there are grains of the quina, with a drachm of the tincture of orange peel, and a drachm of the syrup of the same; completing the draught with water. This I find my patients commonly approve of, except as to its bitterness, which, in a solution, nothing can disguise. Or that salt *may* be administered in the shape of a pill: but it is best and surest in solution.

Questions have been raised respecting the fittest doses of this remedy, and the most appropriate times for administering it: whether it is most effectual when given in repeated small quantities during the intermissions; or when in one large dose shortly before, or shortly after, or during the very progress of the paroxysm. Dr. Home made some experiments on that point in the clinical wards of the Edinburgh Infirmary, some time ago; and he thought that the result was in favour of the plan of giving the bark regularly at short intervals. I have told you the amount of my own experience, which, however, is not very great; nor have I had any severe cases to deal with. I think it not improbable that my patients would have been cured quite as soon if I had given the remedy in half the strength. Dr. Barker, of Dublin, has found small doses equally effectual with large ones; and this is very likely to be the case with *specific* remedies. It would appear, however, that in some quartans it is better to give large doses before the return of the paroxysm. Dr. Elliotson gives large doses just *after* the paroxysm; and then smaller doses during the remainder of the intermission, at regular periods. A great majority of those who suffer ague are poor persons. Of course the first object is to make the cure as *speedy* as possible; the next to make it as *cheap* as possible. So that it is not a matter of indifference, or mere speculative curiosity, to ascertain with how little quina you may cure an ague. I repeat that it has hardly happened to me to be disappointed, when I have given the medicine in small doses, as already described: which amount to about twelve grains in twenty-four hours; but, then, I suppose my cases have been well behaved and submissive. Dr. Elliotson states that he is continually obliged to give twenty or thirty grains in the twenty-four hours, before he can cure the complaint: sometimes in obstinate quartans, forty-five grains; and he mentions one case in which a scruple of the sulphate of quina, with ten minims of the liquor arsenicalis, was given every eight hours in vain, but succeeded perfectly when given every six hours.

It appears also, upon the testimony of careful observers, that in warm climates larger doses *are* necessary. In the aguish tracts of Italy, in the Maremna, small doses are said to be inadequate; and the physicians there are in the habit of giving twelve, twenty-four, or even thirty grains at a time: and in one recorded instance, the dose, in seven days, was got up to 108 grains, before the ague was arrested. The medium dose, in many parts of America, seems to be eight grains.

In this country it has been the custom to prescribe the bark, or its equivalent substitute, in the intermissions only, and to suspend it during the fits. But our American brethren have taught us that this forbearance is unnecessary; that the quina may be given during the paroxysm with perfect safety, and with much advantage; and that, in the severer remittent fevers, the real hazard lies in abstaining from its use, until a comparatively apyrectic period may arrive.

Respecting any drug, it is desirable to possess some easy test that the amount of it administered has reached the limits of sufficiency and safety;—the limits beyond which it is needless, and might be hazardous, to carry it. Now it has been ascertained that when the quina is given in repeated and gradually increasing doses, it comes at length to affect most persons with peculiar sensations (generally spoken of as sensations of fulness) about the head, and with a sort of buzzing noise in the ears. Sometimes, when thus administered, it reduces, in a remarkable degree, the force and the frequency of the pulse. Very different quantities are requisite to produce these symptoms in different individuals; but whenever the buzzing is experienced, you may conclude that the system is conscious of the full force of the remedy, and that to push it further would be inexpedient.

There are some interesting and valuable remarks on this subject in Dr. Murchison's 'Notes on the Climate of Burmah.' He resolved, on his first arrival in India, to put to the test the practice which Dr. Christison had recommended in his lectures, of giving in the tropics a large dose at once; such as thirty-six grains, which was believed to be the average quantity required in India. The result of Dr. Murchison's experience, which became large, amounts to this;—that the method most effectual in checking the paroxysms of ague is that of giving one large dose of quina, a scruple or more, as early as possible after the commencement of the sweating stage. This he followed up, by way of precaution, by a few two-grain doses, twice or thrice a day. In fifty-six of ninety-five cases thus treated, or 59 per cent., the paroxysms were immediately stopped, and did not return: in thirty-six cases, or 37 per cent., there was but one paroxysm; and in the remaining three cases there were but two paroxysms, after the large dose of the remedy. On the other hand, of sixteen cases treated in the ordinary manner, by repeated doses of two or three grains each during the intermissions, the paroxysms were not stopped in a single instance. In five cases, one paroxysm occurred after the drug was begun; in seven, two; and in four, three paroxysms.

Dr. Murchison shows also, in a very striking way, that a cure is to be obtained more cheaply by the single large dose, than by the comparatively small and repeated doses. In ninety-two cases treated by one large dose in the third stage, the average quantity required to repel the complaint was twenty-three grains and a fraction; whereas the average quantity required for the same purpose when the quina was given in repeated small doses was nearly twice as much, namely, forty-five grains and a fraction. And he enters into a curious calculation to show that, reckoning the sulphate of quina to cost nine shillings an ounce, the difference in the expense of the two modes of prescribing it, in our Indian possessions, would exceed the vast sum of 2,000*l.* per annum.

This costliness of the quina was owing, in great measure, to the reckless destruction of the cinchona forests in South America by the collectors of the bark, who took no pains to prevent the death of the trees which they stripped, or to replenish the soil with fresh plants. The scarceness thus occasioned is now fortunately remedied by the successful transference of the quina-yielding cinchona trees into India. The result of their cultivation in that country has been most encouraging; especially on the Neilgherry Hills, and in the neighbourhood of Darjeeling. Among the best are the varieties called Calisaya and Succirubra. The bark of one variety, to which the epithet Mirabilis has been given, contains not less than 13½ per cent. of quina-alkaloid, and more than 9 per cent. of the crystallised quina.

The irritability of the stomach is sometimes so great as to make it difficult to introduce a sufficient quantity of the remedy into the system. This difficulty was very much felt at Walcheren: it is in a great measure removed since the discovery of quina. But even the quina sometimes sits ill on the stomach; and often it is scarcely possible to get children to swallow any preparation of bark, on account of its bitter taste. It is an important thing to know, therefore, that this drug has been found scarcely less effectual in curing the disease, when thrown into the rectum. The menstruum in which it is dissolved should not exceed two or three ounces, lest the bowel should reject it. Its expulsion may sometimes be prevented by adding a few drops of laudanum to the enema.

It is said that bark in substance will sometimes cure the disease when quina fails. I have never witnessed this: but in obstinate cases I would give the quina in the *decoction* of bark.

You must not be satisfied with merely stopping the paroxysms. Patients are often too ready to give up their medicine, as soon as the paroxysm has once missed. But the disease is very apt to recur; and it will always be right and prudent to go on with the quina for ten days or a fortnight after the patient *seems* cured, gradually diminishing, after the first week, the amount and the frequency of the doses.

There have been some curious facts observed in regard to the relapses that are apt to take place after the bark or the quina has been omitted. Clark of Dominica states that if no more of the remedy be taken, in the West Indian ague, than is barely sufficient to stop a fit, and then the bark be suspended, a relapse may take place on the eighth day, in the case of a quotidian; on the fourteenth or fifteenth in the case of a tertian or double tertian; and on the twenty-first or twenty-second in the case of a quartan: thus making (you see) in each type, seven periodical revolutions from the time the fit was suppressed, to the next attack; and the fit was found to return on the proper day, at the same hour at which it would have returned if its course had not been interrupted by the administration of the remedy. Here we have a still earlier glimpse of the abiding periodic tendency, noticed by Dr. Gregory and by Dr. Graves, during the long protracted absence of actual paroxysms. All this is very curious, and inexplicable; but it points clearly to the propriety of continuing the remedy for some time after the disease may appear to have vanished.

Arsenic is another substance which has unquestionable and great power over ague. It carries with it these marked advantages: it is efficacious; it is cheap; and it is tasteless. It is well adapted by these qualities for the poor, and for children, and for patients of every age and rank in whom there is much irritability of stomach present; but then it has also the serious disadvantage of being an active poison. One over-dose might be fatal: and even its long-continued use in minute doses leads sometimes to evident and lasting disorder of the health. Arsenic, therefore, is an unsafe remedy to be trusted in the hands of the ignorant. It should never be administered except under the immediate supervision of a medical eye; and even then it requires to be given with much caution. Its bad effects may be very certainly prevented, however, by care and attention; and it becomes a valuable instrument of cure, and should be adopted without scruple, in cases where its operation can be watched, and where the quina does not agree with the stomach, or fails to stop the disease. I often prescribe arsenic for other complaints; but, as I said before, I have scarcely ever been foiled in removing ague by the sulphate of quina. Some persons are of opinion that relapses are less frequent after the cure by arsenic than after the cure by bark. It would require a large induction of particular facts to make that point clearly out.

When substances, which even in small quantities prove active poisons, are used as remedial agents, it is convenient to have some definite form in which they may be administered at all times, and in all places. The *liquor arsenicalis* of the British Pharmacopœia supplies such a form. This is the form in which arsenic was recommended to the public by Dr. Fowler: and it is therefore sometimes called *Fowler's solution.* It was founded upon an analysis of the *tasteless ague drop*, which had been in considerable repute in some parts of England. The pharmacopœial preparation is an arsenite of potass, in solution.

There are eighty grains of arsenic in the new or imperial pint, and therefore four grains in an ounce of the solution. Ten minims two or three times a day are a full dose for an adult; and you had better begin with not more than five minims. Ten minims contain one-twelfth of a grain. Twice that quantity has been administered at once; but this ought never to be done except when the system has been gradually inured to the arsenic, and thereby enabled to bear such a dose. It is a good precaution not to give this corrosive substance on an empty stomach. The British Pharmacopœia contains an *arseniate of soda*, which is also a very useful preparation, and may conveniently be prescribed in pills.

The poisonous or hurtful effects that we have to look out for, when arsenic has been prescribed, are some heat and dryness of the skin, acceleration of the pulse, a peculiar silvery whiteness of the tongue, loss of appetite, nausea, and sometimes vomiting; griping pain of the stomach and bowels, and diarrhœa; and if the medicine be continued, *fainting* is often added. Other symptoms, less constant perhaps, and less important, are painful and hot tumefaction, stiffness, and itching of the face and eyelids, with redness of the conjunctivæ, or even a tingling eruption something like nettle rash. These effects may, I believe, be controlled by adding a few drops of laudanum to each dose; but I would rather advise you to suspend the use of the arsenic; or to leave it off altogether. When this is done, the unpleasant symptoms will readily yield to mild laxatives, followed by opiates.

When the paroxysms continue to recur in spite of the bark, it has been recommended (and I think the plan a good one) to try to stop them by arsenic; and then, the periodic recurrence having been broken, to employ sulphate of quina to prevent a relapse. Again, when the complaint has been checked by quina, the cure may sometimes be conveniently completed and confirmed by arsenic.

These, then, quina and arsenic, are the two sheet anchors to which we trust, in the cure of ague. A host of other remedies, I say, have had their praises sung. I do not intend to enumerate them. But there are a few which I think it right to mention, for reasons already assigned. There is strong evidence of the efficacy of some of them; they are cheap, and easily accessible, and above all, safe; and therefore, in aguish districts, they may with much propriety and benefit be recommended to the poorer classes, or distributed by Lady Bountifuls.

One of these is *willow-bark;* in substance, or in decoction. If this does cure agues, as it is affirmed to do, it would seem as if Providence had placed the antidote alongside of the poison; for these trees, as you know, abound and flourish in marshy places. The bark of the willow furnishes an alkaloid substance called *salicine*, in which the febrifuge property is believed to reside. Holly leaves, and *ilicine* derived from them, stand in much the same repute, in France, as willow-bark and salicine here.

Another curious remedy, said to be very successful, is the *web of the black spider*, which inhabits barns, stables, and cellars. This substance has been tried on a tolerably large scale, and the testimony to its influence in curing agues is very strong. Dr. Craigie has given this account of it. In the year 1760, a number of prisoners from the vanquished squadron of Thurot having been landed in the Isle of Man, Dr. Gillespie, who was practising there, found that many of the agues which came to prevail, both among these prisoners and the inhabitants of the island, obstinately resisted bark and such other remedies as he had recourse to. He was informed, by an old French physician belonging to the squadron, of the alleged efficacy of cobweb, in certain forms of the disease. He therefore made trial of cobweb, and found it answer admirably. He was successful with it in more than sixty cases of different types, in the Isle of Man, and he had further experience of its utility subsequently in Ayrshire.

After this, the same remedy was tested in the West Indies, by Dr. Jackson, to whom Dr. Gillespie had recommended it. Dr. Jackson's observations were made in the hospital of the army depôt, in the West Indies, in 1801. Several cases of ague, on which bark, arsenic, or mercury, singly or alternately, had made either a very temporary impression or none at all, were selected for experiment. In four of these cases, two pills, containing each five grains of cobweb, were given at intervals of two hours, commencing six hours before the expected time of recurrence of the paroxysm. The fit did not return. On subsequent trials it was found not only to arrest the course of agues, but to remove various symptoms, such as pain, delirium, vomiting, griping, in ague, and in continued fever, when these symptoms were unconnected with inflammation. Bishop Selwyn has told me that a missionary in New Zealand found spider-pills effectual in procuring sleep, when morphia, hyoscyamus, and the like had been tried in vain; and if they failed, there was no reactive tendency to produce restlessness, or excitement of the brain.

Charcoal is another substance which has been found effectual for the cure of intermittent fevers. You may find an account of it in the tenth volume of the 'Edinburgh Medical and Surgical Journal.' It would seem to be especially useful in those cases in which there is a marked disturbance of the digestive organs; nausea, flatulence, hiccup, diarrhœa, or dysentery. It is said generally to cure the complaint by the time two drachms of it have been taken. It may be given in doses of ten or twenty grains, in arrow-root; or with a few grains of rhubarb. If the power of this substance should be confirmed by future observations, a cheap remedy would thus be open to the poor. A clergyman of my acquaintance assures me that he seldom fails to cure agues among his parishioners by administering to them the snuffs of candles, which he takes care to have collected. He does not inform them of what his black powder consists. I presume that its virtue proceeds from the charcoal it contains; unless it is derived from the confidence his flock is accustomed to place in his specific. The very same remedy, the snuff of a candle, is mentioned by Lind.

Piperine, the crystalline salt of pepper, has obtained considerable reputation of late years, as a remedy for intermittent fever. It was largely tried by an Italian physician, Meli; and Dr. Gordini has repeated Meli's experiments at the hospital at Leghorn. The following are the general conclusions at which these physicians have arrived:—1. Piperine, in doses of six or eight grains, cures intermittents. 2. It is more efficient in powder than in pills. 3. It succeeds in certain cases in which the sulphate of quina fails. And 4. It is more effectual in preventing relapses. I have seen letters from some practitioners in this country, bearing testimony to the powers of the piperine. That pepper will cure ague has long been the vulgar belief; and a very popular remedy for the disease is a teaspoonful of pepper in a glass of gin.

I presume that the efficacy of *chamomile* flowers in the removal of intermittent fever is to be attributed to the piperine which they have been ascertained to contain. These flowers had been long in use for the treatment of ague, before the Peruvian bark was discovered; and they are said to have accomplished a cure, since that time, after bark had failed; but this was before the quina had been educed from it. Heberden advises us to have recourse to chamomile flowers, if the bark should disappoint us. I am always willing to embrace an opportunity of referring to his commentaries, for the exact observations they contain, but above all for the beautiful Latinity of which the whole book is an example. I recommend it strongly to you as being, next to Celsus, the best model you can study for good medical Latin. In reference to the point before us he says, 'Cortex, quanquam rite sumtus, interdum parum efficax est; quo in casu suspicio erit ventriculum sordibus onustum vim remedii impedire. Itaque vomere oportet; quo facto, febris raro non cedit. Quod si redire perseveret, confugiendum est ad flores chamæmeli, quorum contritorum scrupulus dandus est loco drachmæ cinchonæ, et ad idem præscriptum repetendus. Hos flores, sic sumtos, semel atque iterum profecisse expertus sum.'

Several mineral substitutes for the bark, or for arsenic, have been tried and found useful: preparations of *iron* and of *zinc*. From 5 to 10 grains of the sulphate of zinc have been given several times a day; or 3 grains of the oxide of zinc every three hours. Sir Gilbert Blane says that, both in the West Indies and in London, intermittents have been cured by the use of this oxide, when they had previously resisted the Peruvian bark. Sir James M'Grigor also speaks of it in terms of praise, from what he saw of its effects in the agues of the Peninsula during the war.

The bromide of potassium has of late been credited for its curative power over intermittent fever.

Some of the remedies of this mysterious disorder operate upon the mind, or rather upon the nervous system, through the mind. Hence it becomes probable that the *drugs* which have such power over the disease, act also on the nervous system, through the blood. And hence also we derive a confirmation of the opinion, that the disease itself is essentially a disease of the same nervous system. Ague has often been cured by the agency of strong mental emotion, such as sudden and great joy, anger, terror, or eager expectation. Thus we read that Quintus Fabius Maximus was cured of an old quartan on the day of a great battle. Strong impressions upon the imagination, producing feelings of disgust and horror, have had the same effect: such as those caused by drinking blood; swallowing a spider gently bruised, and wrapped up in a raisin, or spread upon bread and butter; keeping a spider suspended from the patient's neck in a nutshell, till it dies; and the like. The undoubted success, in many cases, of charms, must be referred to the principle of *faith*. The patient recovers, because he firmly believes in your power to cure him. Dr. Gregory used to relate the case of a patient in the clinical wards in Edinburgh, who, with sundry ceremonies, swallowed some word, written on a slip of paper: the result was, that he had not another paroxysm. And I perfectly recollect having a great awe, when I was quite a child, of my maternal grandmother, because she was reputed to have the power of curing agues by means of some charm. I believe all that she did was to assure the poor people who came to be relieved from their ague, that they should have no more of it *after such a day*; and their implicit reliance upon this prophecy brought about its fulfilment. There seems to be this general principle observable with respect to agues, and to most other diseases which occur in paroxysms, viz., that after they have continued for some time, their further continuance depends more upon the effect of *habit* than anything else: and this habit may be broken by strong impressions made upon the nervous system; and the cure of one paroxysm is often thus the cure of the disease. We have seen examples of the existence of this morbid habit in hysteria, and in some cases of epilepsy. *Cæteris paribus*, that physician will be the most successful in these disorders, who is best able to acquire the confidence of his patient, and to gain a powerful influence over his mind.

There is no disease in which the *prophylaxis* is of more importance; but this you will have gathered from the facts which were stated in the two preceding lectures. The disposition to relapse is strongest soon after the disease has been removed; but it generally continues long, perhaps even for life. The late Dr. Macmichael caught an ague many years before his death, by sleeping on a rock somewhere in Greece; and he was ever after subject to occasional attacks of periodic headache, and other aguish symptoms, for which he was obliged to have recourse to bark or arsenic. Of course one essential point in the prophylaxis is the withdrawal of the patient from the influence of the exciting cause; taking him away from the malarious locality. But this cannot always be done; and when it cannot, we must impress upon him those cautions which arise out of the facts ascertained respecting the operation of the malaria upon the human body. Persons who have been exposed to the exciting cause, or who have once had the fever, should, in whatever place they may happen to be, avoid over-fatigue, and exhaustion of all kinds; sudden exposure to cold or heat; and the neglect of changing wet clothes, wet shoes and stockings for instance. In a malarious district persons should bear in mind the facts, that the miasmata are much more virulent in the night-time than in the day; and close to the surface of the earth, than in a higher part of the atmosphere. They should refrain, therefore, from going out late in the evening, or early in the morning; and they should rather select the attic than any other floor for their bed-chambers. They who are obliged to go out in the morning in countries where agues are rife, should take care not to go out fasting: a good hot breakfast should be first taken, or at any rate some moderate stimulus. A crust of bread and a glass of wine, or a small quantity of ardent spirit, will fortify the system against the pestilential miasma. Measures of this kind have been found extremely beneficial in the navy: the giving, for instance, the men a warm breakfast before going out in the morning on malarious shores in boats, whatever the hour of starting might be. Generous diet, and a fair allowance of fermented liquor, are proper also for all persons in aguish countries. The late Dr. James Gregory used to mention in his lectures an anecdote in point, told him by his father. The elder Dr. Gregory studied at Leyden, under Boerhaave; and twenty-four other English students were living there at the same time: that is, they were called English, on account of their common language, but they were in fact composed of English, Irish, Scotch, West Indians, and Americans. The celebrated John Wilkes and Charles Townsend were among the number. These twenty-five students lived a good deal together; in truth they were *cut*, as the phrase is, by the Dutch, for some raffish behaviour on their parts. However, of the twenty-five, one only was a water-drinker. The other twenty-four drank each a bottle of claret daily; and the water-drinker, and he alone, fell ill of ague there.

Persons who have recently become residents in aguish districts, or who even happen to be travelling through them, would do well to take one or two moderate doses of quina daily, by way of safeguard. Strong evidence has been brought forward of late, by Dr. Bryson and others, to show that its prophylactic power is no less marked and sure, and therefore no less valuable, nay even more valuable, than its curative. Under these circumstances of exposure, warm stomachic laxatives are to be preferred to cold aperients, such as the neutral salts, for due regulation of the bowels.

There is just one more expedient which I would suggest as not unlikely to afford complete protection to those who are of necessity exposed to the malaria; and it is, that they should wear an *orinasal respirator*. It is possible that as a breeze is filtered of the poison which is mingled with it, by passing through a dense mass of foliage, so, on a smaller scale, the air inspired in breathing may be strained and purified, and rendered harmless, in its transit through the sieve-like structure of Mr. Jeffrey's ingenious instrument. The principle of the suggestion is not new; but this mode of applying it has not, so far as I know, hitherto been tried. It is said that by surrounding the head with a gauze veil, or conopeum, the action of malaria is prevented; and that thus it is possible even to sleep in the most pernicious parts of Italy without hazard of fever. Dr. Macculloch states that in Malta, and elsewhere, this belief is universal: and hence the popular practice of covering the mouth and nose with a handkerchief in the morning on going out, or in other suspicious circumstances: a practice (he observes) the efficacy of which is attested, as far as popular belief can attest anything. Can it be the moisture which accumulates upon the handkerchief from the breath that confers the protection? Under inevitable exposure to the malaria, might not Dr. Stenhouse's *charcoal* apparatus, used during the acts of inspiration only, effectually arrest, and perhaps destroy, the entering poison? Professor Tyndall would probably suggest a fence of cotton-wool.

LECTURE XXXVIII.

Epistaxis. Bronchocele; Cretinism: their Phenomena and Probable Causes. Medical and Surgical Treatment of Bronchocele. Exophthalmic Goitre.

I YESTERDAY finished what I had to say respecting intermittent fever: its symptoms; its cause; and its cure. The subtle poison which produces it is thickly distributed over the fairest portions of the habitable globe: blighting human health, and shortening human life, more often, and to a far greater numerical amount, than any other single cause whatever. Known only by its noxious effects, holding out no signal of its presence, this unseen and treacherous enemy of our race has yet been tracked to its haunts and lurking-places, and detected in some of its habits. It was necessary, therefore, that I should enter somewhat fully into the history of the malaria, and show how its influence may sometimes be shunned, sometimes be averted; how, also, in this climate at least, the effects it has already produced upon the human body may be successfully combated. But I shall not pursue, in further detail, the ravages committed by this invisible agent, and the remedies they require, in hotter and less favoured regions than our own. Of these, personally, I know nothing; and I must refer you, for information on such diseases, to authors who have seen and treated them: particularly to Drs. Lind, Jackson, Bancroft, Johnson, and Sir William Burnett.

It is customary with writers and lecturers, to pass from the consideration of ague to that of continued fever. A paroxysm of ague has been regarded as exhibiting a paradigm or sample of fever in general. But this notion has always appeared to me rather an ingenious refinement, than a useful matter of fact. Practically, I see nothing to be gained by the association. Intermittent fever, it is true, does often run, in hot climates, into the remittent, and the remittent into the continued form. But these are very different disorders from the continued fevers with which, in these climates, and in this country, we have to do. Intermittent fever, and continued fevers, as *we* see them, differ in their phenomena, in their causes, and in their treatment. They are alike, inasmuch as they both are called fever, and both are attended, in some part or other of their course, with *pyrexia*; but in essential symptoms, I have known many a compound fracture more like continued fever than any ague that we are likely to witness. I shall take up the subject of continued fevers, then, in connexion with the eruptive febrile diseases, a category to which they unquestionably belong; and I resume the consideration of the disorders that come within the province of the physician, according to their anatomical seat.

After what was stated of hæmorrhage in general, in an earlier part of the course, I hardly know whether *epistaxis* needs or deserves any formal notice. There are, however, some points relating to this simple, and commonly harmless hæmorrhage, which it may be worth while very briefly to touch upon. Sometimes it is a remedy; sometimes a warning; sometimes really in itself a disease. The readiness with which the mucous lining of the nasal passages pours forth blood is familiar to the experience of every school-boy: who 'often wipes a bloody nose.' A slight blow, brisk exercise, a strong bodily effort, a fit of sneezing, or the summer heat, is sufficient, in many boys, to make the nose bleed; and this facility of hæmorrhage furnishes, often, an index of some unnatural state of the circulation: and especially of undue fulness of the vessels of the head. But the import of this symptom is not always the same. Epistaxis may indeed be taken as affording an epitome of the various forms of capillary hæmorrhage. In childhood and early youth it is idiopathic, dependent upon active congestion, and probably arterial. It is nature's favourite mode of blood-letting at that period of life. In old age it is symptomatic, the result of passive or mechanical congestion, and probable venous. In some adult persons it happens periodically, and is habitual: and its *suspension*, rather than its *occurrence*, becomes a token of disease or of danger. In young women it is not seldom vicarious of suspended menstruation: in men it is apt to take the place of hæmorrhöis. Lastly, it may proceed from disease in the nares themselves; or form a part of a more general hæmorrhagic disorder.

It is unnecessary to go at length into the phenomena of epistaxis. The main phenomenon becomes obvious at once both to the patient and to those around him: and the accessory and incidental circumstances are easily discoverable when the attention is aroused to them by the sight of the blood. Usually the blood flows *guttatim*; in a succession of drops: but these may follow each other so fast as to constitute a little stream. Sometimes a few drops only fall; sometimes several pints are lost. A moderate hæmorrhage of this kind is generally succeeded by a sense of relief and refreshment. A large efflux of blood may cause pallor, faintness, debility, exhaustion, even death.

Active idiopathic epistaxis, as it occurs in children, is almost always salutary, and may be left to work its own cure. When it runs into excess, or is too often repeated, it may be checked by applying cold water to the forehead and to the bridge of the nose. The sudden contact of some cold substance with a distant part of the surface of the body will often have the effect of restraining the hæmorrhage: apparently by producing a general and sympathetic constriction of the superficial blood-vessels. This is doubtless a reflex phenomenon. The nursery remedy is to slip a cold key down the child's neck, between its back and its clothes. The aspersion of cold water is still better. Dried matico leaf, crumbled into a powder, and snuffed up the nostrils, will often stop the bleeding at once. Powdered tannin, used in the same way, and the vapour of turpentine inhaled through the nose, have also been found effectual styptics. Besides these external appliances, cooling laxatives should be given; and if the bleeding prove obstinate, some astringent internal remedy may be thought proper. Those which I have found the most efficacious are the gallic acid and the acetate of lead.

When epistaxis *begins* to show itself in advanced life, it is a symptom which cannot safely be neglected: for it indicates that the veins of the head are loaded. It implies a morbid condition that requires to be redressed. You will look for disease of the heart—or for threatenings of apoplexy—and take your measures accordingly. The blood-vessels which ramify upon and beneath the pituitary membrane, communicate by indirect inosculation with the veins and sinuses of the skull, as well as with the jugular veins. You see, therefore, how it is that hæmorrhage from this membrane may perform the office of a safety-valve, and protect the important organ within the cranium from impending mischief.

On the other hand, when epistaxis, which is known to have been habitual, fails to recur at or about the usual periods, you will look, with a jealous care, into your patient's state, and watch for and obviate any tendency to plethora capitis.

When epistaxis forms a part of more general hæmorrhagic disease—as when it occurs among other symptoms of purpura—its treatment merges in that of the whole malady.

In any case, if the flow of blood be excessive, and cannot be restrained by the ordinary remedies, but is exhausting the patient's strength, it becomes an absolute disease: and it will be requisite to staunch the blood by manual expedients.

These consist in stopping the bleeding orifices mechanically; which is most effectually to be done by plugging the cavity. A dossil of lint must be carefully inserted into the bleeding nostril. Its mechanical effect, which is pressure, may be chemically aided by first wetting the lint with a saturated solution of alum. The mode of introducing these plugs it is the business of the surgeon—and not mine—to teach. The operation is not a very comfortable one either to bear or to perform.

A very simple mechanical remedy has been lately announced by Dr. Negrier, of Angiers; who discovered it (he says) by mere accident. The patient is to raise one or both of his arms above his head, and to hold them for some little time in that position. Dr. Negrier declares that during an experience of three years he has never known this method fail to arrest the bleeding. His explanation of its *modus operandi* is not very satisfactory. The expedient itself is however so easy, so prompt, and even if unsuccessful so harmless, that its real value deserves to be tested—and will soon probably be settled—by an ampler trial.

Before we trace this mucous membrane downwards, through the mouth, to the inside of the throat, let me turn your attention to a singular disorder which may be deemed external, for it is scarcely more than skin deep: I mean that enlarged state of the thyreöid gland to which the name of *bronchocele* has been given. This word is not merely derived from the Greek, but was used by the Greek writers in the same sense in which we now employ it. In Switzerland, where it is very common, and in France, the complaint is called *goître*; a derivation, it is believed, from the Latin 'guttur,' the throat. It is known in England as the *Derbyshire neck*; from its frequent occurrence in that county.

The term bronchocele has been sometimes applied indiscriminately to all protuberances or swellings in front of the throat; or, at any rate, to all enlargements of the thyreöid gland;

whereas it should be restricted to *hypertrophy* of that part: an exaggeration of its natural structure, with augmentation of its volume. The texture of the gland becomes coarser; its blood-vessels grow larger and more numerous; its cells are magnified, and filled with a thick, viscid secretion. It usually presents a soft, smooth, elastic tumour, which is neither painful, nor tender, nor discoloured. The lobes of the gland become more obvious. Sometimes the whole tumour is irregularly lobulated: sometimes the exact form and relative proportions of the gland are preserved, each lobe and portion being equally increased in size. Occasionally there is a soft uniform or irregular swelling, without much distinction of parts. Alibert states that the right lobe is more frequently enlarged than the left. Mr. Rickwood found it so in every instance of bronchocele that came under his notice in the neighbourhood of Horsham.

Unless the tumour be very large, it follows all the motions of the larynx: and this is a point of considerable importance whenever the diagnosis is at all doubtful. It is just possible that an enlarged lymphatic gland, or an encysted tumour in the neighbourhood of the larynx, or even a collection of pus thereabouts, might, in some measure, embarrass the diagnosis. But, by placing the head and neck in different successive positions, swellings of this accidental kind may, in general, be ascertained to be unconnected with the larynx: and they do not follow its up and down movements when the act of swallowing is performed.

It is of importance to know, also, that the gland itself is subject to different kinds of enlargement. It may swell from inflammation, chronic or acute: and then it will be hard, and tender, and painful. But it does not seem very prone to inflame; and probably Dr. Copland is right in his opinion that inflammation occurs spontaneously in this organ in scrofulous persons only. Baillie and Alibert speak of it as being occasionally the seat of cancer; but that must be very rare. Sometimes cartilaginous or ossific deposits take place in the gland. It is necessary, I say, to be aware of these circumstances, and to distinguish one kind of thyreöid tumour from another: for some of the morbid changes just referred to are clearly beyond the power of any *medicine* to remove; and if all forms of enlargement incidental to this part are lumped together under one common name of bronchocele, we shall be liable to arrive at false conclusions concerning the power of remedies over that disease.

Bronchocele is not, *in itself*, a painful disorder: nor does it taint the system, or affect the constitution in any way. It has no quality of malignancy about it. It is always, however, a deformity; and by its mechanical effects, that is, by its weight when large, and by the pressure it exercises on contiguous parts, it may occasion great distress, and suffering, and even death itself. The size, and the effects, of the tumour both vary much in different cases; but its *injurious* effects are not always, though they are generally, in proportion to its bulk. Sometimes there is no more than a slight fulness of the throat, which some persons, I believe, think rather graceful than otherwise. Now and then, the swelling, after its first commencement, develops itself with great rapidity, but its ordinary progress is slow. It often continues for months, or years, without reaching any extreme or very troublesome magnitude. Sometimes it remains stationary for a considerable time, and then *suddenly* increases, without any apparent cause. The worst effects of bronchocele are its interference with the circulation, and with respiration. By its pressure it may obstruct the free descent of the blood through the veins of the neck, and give rise to headache, giddiness, noises in the ears, confusion of thought, and a turgid condition of the head and face. Or, by pressing upon the wind-pipe, it may cause hoarseness, wheezing, and dyspnœa. It may even impede deglutition. But these effects, I say, do not depend altogether upon the actual size of the tumour. A very large goitre may produce no other inconvenience than what results from its weight, and its unseemly appearance. It may surround all the front and sides of the neck like a thick collar, and rise as high as the ears; or it may hang down in a pendulous lump, and be supported upon the chest. Nay, the tumour is said to descend, in some rare instances, so low as to be in contact with the abdomen: and Alibert mentions one case in which the swelling was of a tapering cylindrical shape, and reached to the middle of the thigh. On the other hand, a small tumour, not bigger than one's fist, especially if it happen to occupy the central portion, or what is called the isthmus, of the gland, may so press inwards upon the trachea as materially to hinder the breathing, and even to threaten suffocation. A pupil now attending the hospital has informed me of a case, which he himself saw, of death produced by the encroachment of a bronchocele; not so much, however, from suffocation as from starvation: for the swelling encircled the trachea, and came at last to press so much upon the woman's œsophagus, that she could not get food into her stomach. I suppose that the reason of these differences may be sometimes found in the manner in which the tumour grows, and in its relative situations. When it is bound down by the muscles of the neck, it presses, as it continues to enlarge, upon the parts behind it. When it is not so confined, the skin readily yields, and the entire growth of the tumour takes place anteriorly.

This disease is much more common in women than in men. Indeed we seldom see it, in this country, except in females. Yet I happen to have an example of it now (December 1837), in a man among my patients in the hospital. Dr. Andrew Crawford states that forty-nine cases were admitted into the Hampshire County Hospital, in ten years, and forty-eight of these were in women. Of seventy patients admitted at the Chichester Infirmary in nine years, two only were males, and they were boys of a very feeble and feminine habit, and backward for their years. Among one hundred and sixteen patients of Dr. Manson's, fifteen were men. Taking an average from these three lists, we have one male for twelve females. It is well to bear in mind that our fashion of dress renders a small bronchocele much more noticeable, much less easily concealed, in women than in men. In the former the swelling has been known to come on, or at any rate to increase rapidly, during their confinement in child-bed: and it is frequently observed to undergo a temporary enlargement at the menstrual period. Dr. Copland has seldom met with an instance in the female, unconnected with some kind of irregularity in the catamenial discharge, or disorder of the uterine functions; and he never saw a case in which the disease made its appearance before the period of commencing puberty. In Switzerland, and in some parts of India, where the complaint is much more prevalent than here, the proportion of males affected is greater; and it begins, often, prior to the age of puberty, in both sexes. It seldom shows itself earlier than the age of eight or ten. Dr. Elliotson states, indeed, that he himself, when in Switzerland, saw goitre in a little boy only four years old; and the natives told him that it rarely made its appearance before the age of six. But children have been *born* goitrous. M. Godelle, physician to the hospital at Soissons, had a preparation of the body of an infant, which lived a few hours only, and which came into the world with a goitre; the mother being affected with the same kind of deformity. A case is mentioned in the 'London

Medical Repository' of a child born in Derbyshire with bronchocele of considerable size. The disease, therefore, undoubtedly may be *congenital*: and one of the facts I have just mentioned points to the question of its being *hereditary*. It is said to be so; and there is much probability in favour of that opinion. Children born of goitrous parents often have goitre. But that, you will say, may depend upon their being in the same place, and exposed to the same causes, which produced bronchocele in the mother or father. Dr. Crawford states, however, that he knew a woman, with goitre, whose grandmother, father, paternal aunt, and cousins, also had it, although they did *not* all live in the same place, and no other person in their respective neighbourhoods was affected by the disease.

Admitting, what seems probable, that the disease may sometimes be hereditary, in the sense in which I formerly explained that term, there can be no doubt that it is often *acquired*.

In the first place bronchocele is *endemic*—prevalent in certain localities, and scarcely occurring elsewhere. And persons who, being previously well, go to live in those localities, often become affected with the complaint: and persons who migrate *from* those localities, having the complaint upon them, sometimes get rid of it by the mere change of residence. The physical circumstances of the places thus selected by the disease have been studied with the natural hope of discovering what the cause may be of an effect so remarkable. Some morbific quality of the *air* was long suspected. The habitats of the unknown cause of bronchocele appeared at first sight to be very much like those of the malaria. Goitre abounds in the hollows of many mountainous districts; among the Alps, for example, and in the Pyrenees. This was notorious to the ancients. Juvenal asks—

> Quis tumidum guttur miratur in Alpibus?

And it is in the deep, close, and moist valleys of Switzerland, which lie at the feet of, and between, high mountains, that bronchocele is most common. Several writers, who have personally investigated this subject in places where goitre is rife, concur in the belief that it depends upon insalubrity of the air, arising from the peculiarities of the situation. They affirm that it is most frequent in low, damp, confined spots, where the stagnant atmosphere is seldom stirred by wholesome breezes; and where the sun, in summer, has great power. Dr. James Johnson remarks, 'We find in the Valais (one of the Swiss cantons) and in the lower gorges or ravines that open on its sides, both cretinism and bronchocele in the most intense degrees. As we ascend the neighbouring mountains, cretinism disappears, and goitre only is observed. And when we get to a certain altitude, both maladies vanish.' Dr. Reeve, again, states that 'all the cretins he saw were in adjoining houses in the little village called La Batia, situated in a narrow corner of the valley, the houses being built up under ledges of the rocks, and all of them very filthy, very close, very hot and miserable habitations. In villages situated higher up the mountains, no cretins are to be seen.'

The *cretinism* mentioned in these quotations is a strange and melancholy disease; a sort of idiotcy, accompanied by (and doubtless dependent upon) deformity and imperfection of the bodily organs. The mental affection exists in all degrees, from mere obtuseness of thought and purpose, to the complete obliteration of intelligence. Many of the cretins are incapable of articulate speech; some are blind, some deaf, and others labour under all these privations. They are mostly dwarfish in stature, with large heads, wide vacant features, and goggle eyes, short crooked limbs, flabby muscles, and tumid bellies. The worst of them are insensible to the decencies of nature, and obey, without shame or self-restraint, every animal impulse. In no other class of mortals is the impress of humanity so pitiably defaced.

More recent and extensive observation of the localities infested by goitre have rendered it improbable that the disease derives its origin from any deleterious properties of the air. Certainly it is not owing to anything that is common to *all* mountainous countries. Some parts of Switzerland are free from it. So are the Highlands of Scotland. It is met with also in flat situations—as in Norfolk. I have seen several cases of it in Cambridgeshire, which is a *very* flat county. In one village in particular, about five miles from Cambridge, it is extremely common. There are some striking facts collected by the celebrated and philosophic Humboldt, which go to show that the prevalence of bronchocele does not depend on any particular configuration of the surface of the earth, nor on any peculiar condition of the atmosphere. He tells us that in South America bronchocele is met with, both in the upper and the lower course of the Magdalen river; and in the flat high country of Bogota, 6,000 feet above the bed of the stream. The first of these regions is a thick forest; while the second and third present a soil destitute of vegetation. The first and third are exceedingly damp; the second peculiarly dry. In the first the air is stagnant; in the second and third the winds are impetuous. In the first two the thermometer keeps up all the year at 22 or 23 degrees of the Centigrade scale: in the third it ranges between 4 degrees and 17.

The researches of Mr. M'Clelland, in India, lead to the same conclusion. He found goitre extremely frequent in one portion of the district which he surveyed, while the other portion was almost exempt from the complaint, 'although an equality of moral as well as physical circumstances appear to affect the whole. The external alpine characters of the province are the same in every part, the inhabitants all belong to the same tribes of Hindoos, and are subject to fewer irregularities in their mode of life than any other people in the world.'

The different localities of the villages, in the portion where goitre was *not* prevalent, he describes as being as diverse as can well be imagined. 'Some are erected on narrow ridges, others in deep valleys, surrounded by abrupt and lofty mountains; others on rugged declivities, between lofty peaks on one side, and deep ravines on the other, into some of which the sun can scarcely penetrate. The different altitudes of these villages vary from 2,000 to 6,000 feet.'

Facts of this kind have turned the attention of scientific inquirers towards the only other obvious source to which the disorder could, with probability, be attributed, viz., the quality of the *water* used for drinking. Wherever goitre prevails, the popular belief assigns it to the water, as a cause: and the more accurately the search is prosecuted the more strength and likelihood does this supposition acquire. Its very universality is a presumption in its favour. The disease was formerly ascribed to the use of *snow* water: a notion which originated, I imagine, in its frequent occurrence in alpine regions. But the people in almost *all* the valleys of Switzerland drink the water that comes from the glaciers; while bronchocele is known in *some* of the valleys only. It prevails also in certain spots where pump water is used, and *there* the people accuse the *pump* water of producing it. Besides, goitre occurs in other countries, where the snow never lies long, as in Derbyshire; and even in Sumatra, where there is *no* snow. Dr. Bally, a native of a goitrous district in Switzerland, believes that bronchocele is caused by certain *waters*, which issue from the hollow of rocks, trickle along crevices of the mountains, or rise from the bowels of the earth.

And in support of that opinion he refers to some fountains in his own neighbourhood, the drinking of the water of which will produce, or augment, goitrous swellings, in eight or ten days. Such of the inhabitants as avoid these waters are free, he says, from goitre and cretinism. In Captain Franklin's narrative of his expedition to the shores of the Polar sea, there is the following statement, made by his fellow traveller, Dr. Richardson :—' Bronchocele or goitre is a common disorder at Edmonton. I examined several of the inhabitants afflicted with it, and endeavoured to obtain every information on the subject from the most authentic sources. The following facts may be depended upon :—The disorder attacks those only who drink from the *water* of the (Saskatchanan) *river*. It is indeed, in its worst state, confined almost entirely to the half-breed women and children who reside constantly at the fort, and make use of river water, drawn, in winter, through a hole made in the ice. The men, from being often from home on their journeys through the plain, where their drink is *melted snow*, are less affected: and if any of them exhibit during the winter some incipient symptoms of the complaint, the annual summer voyage to the sea-coast generally effects a cure. The natives, who confine themselves to *snow water* in the winter, and drink of the small rivulets which flow through the plains in the summer, are exempt from attacks of this disease. A residence of a single year at Edmonton is sufficient to render a family bronchocelous. Many of the goitres acquire great size. Burnt sponge has been tried and found to remove the disease: but an exposure to the same cause immediately reproduces it. A great proportion of the children of the women who have goitres are born idiots, with large heads, and the other distinguishing marks of cretins. I could not learn whether it was necessary that both parents should have goitre to produce cretin children.'

We are able even to go a step further, and to announce a probable conjecture as to the specific quality of the suspected water. Bronchocele is very prevalent in Nottingham and its neighbourhood; and the vulgar there ascribe it (so Dr. Manson informs us) to the *hardness* of the water. You know that the rough practical distinction between soft and hard water is that the former *dissolves* soap, while the latter *decomposes* it. The hardness is generally occasioned by the presence either of *sulphate of lime*, or of *carbonate of lime*. In the one case the remedy is to mix the carbonate of an alkali with the water; in the other you simply boil it. Now the well water in and about Nottingham is more or less hard, and unfit for the purpose of washing. Dr. Coindet, of Geneva, declares that the use of hard or pump water in the lower streets of that town brings on the goitre very speedily. At Cluses, on the Arve, numerous cretins and goitrous persons are seen in the streets: lofty cliffs of limestone tower over the town, and through its caverns copious streams of water find a passage. The soil in the neighbourhood of Edmonton was found by Dr. Richardson to be calcareous, and to contain numerous fragments of magnesian limestone. In a 'Treatise on English Bronchocele,' recently published, Dr. Inglis states his belief that the presence of magnesian limestone always implies the co-existence of the disease. 'Take (he says) that ridge of magnesian limestone running from north to south through the centre of Yorkshire, and margining the shires of Derby and Nottingham. All along that line we have goitre to a very great extent; whereas, on our diverging to either side, the disease is found to diminish.'

These scattered indications that the hurtful quality of the water is somehow derived from its contact with limestone rocks, receive a powerful corroboration from the results of Mr. M'Clelland's minute and valuable enquiries, which were carried on in the province of Kemaon, south of the Himalaya mountains. I have not been able to obtain his book; what I am about to tell you I take from a full and instructive notice of it in the fifteenth number of the 'British and Foreign Medical Review.' Mr. M'Clelland finding goitre very abundant (as I mentioned before) in one great section of a district, and almost entirely absent from another section, set himself to find out in what other particulars these sections were distinguished from each other. He ascertained that they completely agreed 'in external aspect, altitude, and climatology,' but differed remarkably 'in their geognostic relations; and this distinction was even traced down to the very villages in which the disease is found, with such perfect nicety, as to enable one almost to predict *à priori*, on examining the rocks of a neighbourhood, whether the inhabitants are affected with goitre or not.'

It would be impossible for me to give you even an abstract of Mr. M'Clelland's numerous observations; but I select one or two striking instances in favour of his opinion that the endemic prevalence of goitre is connected with the use of water impregnated with calcareous salts.

One extremity of the long village Deota, which occupies half a mile of the foot of Durge mountain, is inhabited by Brahmins; the other by Rajpoots and Domes. Of the first caste there are about twenty persons, all of whom are free from goitre. There are forty of the second, and two-thirds are affected, more or less. Of the third caste, forty-six in number, nearly the whole are goitrous. 'To what cause can we ascribe the immunity of one caste of the inhabitants of this village, and the almost universal affection of the other two castes? They are all alike well-fed, and have little toil: their land producing the requisites of life almost without labour. Difference of caste does not here imply a difference of pecuniary circumstances, and consequently of the comforts of life. In these respects the three castes in this village are on perfect equality. Nor will hereditary predisposition acquired by intermarriages be sufficient to explain the interesting fact: for the affected parties are confined to the Rajpoots and Domes, who cannot intermarry, while the Brahmins and Rajpoots may. The village is raised about one hundred feet above the level of the valley; and the mountain, at the foot of which it is situated, rises with a gentle slope, and is not in this vicinity at all rugged. It is chiefly composed of transition limestone, and the village is erected on a conglomerated rock, composed of calcareous tuff, inclosing fragments of other rocks. There is a spring in the valley, about one hundred yards from the village, bearing on its first appearance the character of a mineral spring. The water bursts forth with strong ebullition, in the quantity of at least forty gallons in a minute, and agglutinates the sand and gravel by which it is surrounded by the deposition of calcareous tuff. The temperature and quantity of the water is the same at all seasons. The former inhabitants of the village, aware perhaps of the noxious effects of this spring, had an aqueduct formed, by which water is conveyed into the Brahmin portion of the village from a distant source. The aqueduct having been suffered to get out of repair, the quantity of water it transmits is reserved exclusively for the Brahmins; except during the rainy season, when, the water being plentiful, the Rajpoots also use that of the aqueduct; but the Domes have no alternative at any season but to use the water from the spring.'

The valley of Baribice is elevated 4,000 feet above the sea. Its eastern extremity is composed of *clayslate*, and in five villages, containing 152 inhabitants, there is not one goitre. The other extremity of the valley is partly composed of limestone;

and of 192 inhabitants, distributed in six villages, 70 are affected with goitre: but Ducygong, one of these villages, supplied with water from clayslate, has not a single case of the disease; while Agar, only half a mile distant, and containing 50 inhabitants, has no less than 40 cases; and of that number 20 are cretins. They use the water which issues from an old copper mine in limestone, and which contains carbonate of lime, and of soda, but no sulphate.

Mr. M'Clelland affirms that in the course of his personal enquiries, which extended over one thousand square miles, and which were prosecuted without regard to any theory, no instance occurred, in which goitre prevailed to any extent where the villages were not situated on, or close to, limestone rocks.

It is stated by Dr. Aitken that Mr. Ceely has found solid aggregations of calcareous particles in the thyreöid glands of goitrous patients at Aylesbury, the soil there being mainly limestone.

Cretinism has a close, but an ill-understood, connexion with goitre. Wherever cretinism is endemic, bronchocele never fails to be abundant. But bronchocele may prevail in a place where there are no cretins. With but few exceptions, cretins are goitrous; whereas many of those who have bronchocele are not affected with cretinism. The two disorders either spring from the same cause, requiring for their joint production that this cause should be in active operation: or, if they have separate causes, these frequently co-exist and act in combination. It is said, I know not with what accuracy, that when both parents are goitrous for two generations in succession, the offspring, being in the third generation, are sure to be cretins. Certainly cretinism is most common where bronchocele is most common, and especially in mountainous places. It occurs in the Pyrenees as well as in the Alps, in the mountains of Syria, in the hilly parts of China, and in the Himalaya regions. Yet cretinism is confined within much more limited bounds than goitre. Saussure, Fodere, and Dr. Reeve, agree entirely as to the circumstances under which cretinism appears to be most commonly engendered in Switzerland. They say that the disease is usually met with in valleys which are nearly surrounded by high and steep rocks, where there is but little circulation of air, and where the inhabitants are exposed to the direct rays of the sun, and to the reflexion of them from the rocks: and also to effluvia from marshes. It is in the filthy habitations built in these close, hot, and humid situations, that cretinism abounds most. The children that are taken away from the low valleys, and carried up, when young, into the high grounds, escape the disease; or even get the better of it if removed soon enough. And the amendment is said to be perceptible even in a very few days. These facts have led many persons to conclude that cretinism, if not bronchocele, depends on some condition of the *air*. It appears to me probable that the exciting cause of both is the same, and that the local circumstances just now mentioned operate as predisposing causes only. Cretinism, as well as goitre, was observed, by Ramond, in the 'open, well-watered, and well-ventilated valleys of the Pyrenees.'

There are some difficulties opposed to the implicit reception of the opinions formed by Mr. M'Clelland and by others, respecting the origin of these diseases. And the facts upon which those opinions are grounded are not without apparent exceptions. Moreover, the actual substance which exercises or confers the noxious power, has yet to be ascertained. This etiological problem, so full of interest, is not solved. One step more, and probably one step only, remains to be taken. We look to the medical geologist for its complete solution; and I trust that, now, we have not long to look. The deleterious agent has been traced, with tolerable certainty, to water: and hence to some element of the soil washed by that water. And if what at present is probable only, shall hereafter be proved,—namely, that the hidden cause of goitre and of cretinism lurks in some chemical quality of man's natural beverage—it can scarcely be doubted that chemistry will be found ready to supply a simple and effectual corrective of the evil. This hope it is which makes it so important that medical men should be accurately possessed of the present state and bearings of the question; and prepared to take advantage of every opportunity that may arise for its practical determination. For surely it would be a noble achievement of our art, and a signal blessing provided for hundreds of human beings yet unborn, thus to prevent the deformity, the discomfort, and the sometimes danger, of bronchocele; and to forbid, in its very source and fountain, the more hideous and loathsome disfigurement, of mind as well as of body, that distinguishes the wretched cretin.

I ought, perhaps, to tell you, that other causes, many of them very vague and unsatisfactory, have, at different times, been assigned. Thus Valentin supposes the disease to be more common in women than in men, simply because women more frequently have the neck uncovered. It has been affirmed that young women who have taken the veil in Catholic countries have lost their goitres in consequence of the change then made in their costume; and a medical man in Guatemala asserts that the same infirmity has sensibly diminished among the men in that part of the world, since cravats became fashionable there. These views of the matter accord with some whimsical notions entertained by the late Sir Anthony Carlisle. He held that the chief purpose of the thyreöid gland was to protect the delicate organ of the voice from the injurious influence of cold; and he consequently regarded the tumour of bronchocele as being rather of a sanative than of a morbid nature. He looked upon it as an additional greatcoat thrown over the important instrument of speech, in circumstances of extraordinary need. His theory agrees with some of the facts on which other theories, not perhaps more plausible, have been founded. Thus although snow water may not be, indeed I may say certainly is not, the cause of bronchocele from any peculiar quality that belongs to it, yet the disorder is confessedly frequent in many places where snow water is habitually drunk; i.e. as Sir Anthony would have reasoned, where *very cold* water is frequently drunk; the swelling being a provision of nature to obviate the hurtful effects which might else be produced on the larynx by these cold potations. The summer change for the better, described by Dr. Richardson, consists also with the same theory: which would suggest the covering an incipient bronchocele continually with warm clothing, such as flannel, to check its growth, to obviate its necessity, and so gradually to occasion its subsidence. And this plan is mentioned, I see, by Bouillaud, among the curative indications.

I mention these theories, not because I have any faith in them myself, but as being curious specimens of the manner in which the human mind strives to account for obscure phenomena; and as showing how readily facts may be culled and pressed into the service of very slender and infirm hypotheses.

One very important point—preliminary to all rational *treatment* of bronchocele or of cretinism—is obvious; the removal of the sufferer, whenever that can be done, from the infested locality. This was the first care of that great friend of the unhappy race of Cretins, the late Dr. Guggenbühl, who founded on the Abendberg in the Bernese Alps, at an altitude considerably higher than that below which these kindred disorders are generally met with, a hospital for the reception of Cretin children. To their cure and comfort Dr. Guggenbühl generously devoted his whole mind. The success of this philanthropic experiment, the beneficial influence of pure air, and of judicious medical and moral discipline, upon these poor patients, was signal and gratifying. Of the whole number of Cretins admitted during a period of twelve years, one-third were perfectly restored to health and reason, while the rest improved much both in body and in mind.

This most useful and praiseworthy institution, which has now ceased to exist, was the parent and model of the Asylums for Idiots which have been founded, and are happily multiplying, in England and elsewhere.

When removal to a more salubrious place has been accomplished, or when the disorder occurs sporadically, as it sometimes does, we may administer drugs with better hope and advantage. Now a great variety of empirical remedies have been recommended for the cure of bronchocele, concerning most of which it would be a waste of time for me to speak at all. The remedy which, as an internal medicine, has of late years superseded all others, and acquired the reputation of a specific against goitre, is iodine: and it certainly has a remarkable influence over the genuine unmixed form of the disease, whether endemic or sporadic—the hypertrophied gland; yet it does not, perhaps, merit the title of specific in the same absolute sense as that in which we say that bark is a specific for the ague, or sulphur for the itch. Dr. Coindet, of Geneva, was the first who made this remedy extensively known. Dr. Straub, however, of Hofwyl, has laid claim to the priority of its use. Probably that happened in this matter which has often happened in others, viz., that the state of knowledge was ripe for such a discovery, and it was made by each of these physicians independently of the other. Dr. Coindet's name, however, has been inseparably connected with the application of iodine to the cure of bronchocele, in a work which, if he had no other claim to be remembered, would immortalize his memory;—I mean Sir J. Herschel's profound and beautiful 'Discourse on the Study of Natural Philosophy;' a book which I should advise those among you who have not already read it, to make themselves masters of as soon as they have leisure to do so. He thus strikingly illustrates an observation of his own, that mighty benefits often accrue to science from the casual experience of even unscientific or illiterate persons. 'A soap manufacturer remarks that the residuum of his ley, when exhausted of the alkali for which he employs it, produces a corrosion of the copper boiler, for which he cannot account. He puts it into the hands of a scientific chemist for analysis: and the result is the discovery of one of the most singular and important chemical elements—iodine. The properties of this being studied, are found to occur most appositely in illustration and support of a variety of new, curious, and instructive views then gaining ground in chemistry; and thus to exercise a marked influence over the whole body of that science. Curiosity is excited; the origin of the new substance is traced to the sea-plants from whose ashes the principal ingredient of soap is obtained; and ultimately to the sea-water itself. It is thence hunted through nature, discovered in salt-mines and springs, and pursued into all bodies which have a marine origin: among the rest into sponge. A medical practitioner, Dr. Coindet, of Geneva, then calls to mind a reputed remedy for the cure of one of the most grievous and unsightly disorders to which the human species is subject—the goitre—which infests the inhabitants of mountainous districts to an extent that, in this favoured land, we have happily no experience of, and which was said to have been originally cured by the ashes of burnt sponge. Led by this indication, he tries the effect of iodine on that complaint, and the result establishes the extraordinary fact that this singular substance, taken as a medicine, acts with the utmost promptitude and energy on goitre, dissipating the largest and most inveterate in a short time, and acting (of course, like all medicines, even the most approved, with occasional failures) as a specific, or natural antagonist against that odious deformity.'

It is curious enough, and marks the accuracy with which the effects of remedies may be observed, that not only had burnt sponge been found efficacious in removing bronchocele, but the bladderwrack also, the fucus vesiculosus, the plant that, with others of the same family, yields the soda wherewith the iodine was found combined. Dr. Gairdner, who was the first I believe in this country to write on the effects of iodine, accounts for the frequent failure of even large doses of the burnt sponge, by showing that it was much adulterated with charcoal. Dr. Manson, of Nottingham, has published the following tabular statement of the results of the employment of iodine by himself. He had treated one hundred and sixteen patients, of whom fifteen were men and the rest women. Of the fifteen men, ten were cured, three were improving and under treatment at the time of his publication, one was dismissed for irregular attendance, and one was much relieved. Of the one hundred and one women, sixty-six were cured, nine much relieved, two received no benefit, ten were discharged for irregular attendance, and fourteen were improving under treatment. Of the whole one hundred and sixteen, therefore, there were seventy-six positive cures, or two-thirds of the entire number; and only two positive failures. Dr. Coindet was successful in about the same proportion of cases. This is strong evidence of the power of the remedy. Dr. Manson found that in some, but not in all individuals, after the preparations of iodine had been given internally for a certain time, they were apt to occasion headache, giddiness, sickness of stomach, with some degree of languor and inaptitude for exertion. His plan in such cases was to suspend the use of the medicine, or to reduce the dose. The following effects of the iodine are stated by Dr. Coindet as having occurred in his practice:—Acceleration of the pulse, palpitation, dry cough, watchfulness, marasmus, and prostration of strength. Sometimes swelling of the legs supervened, tremors, painful hardness of the bronchocele, diminution of the breasts, and a remarkable increase of appetite; and he adds that in almost all the instances which he had observed, a very rapid diminution, or a disappearance more or less complete, took place, during the presence of these symptoms, of even hard, bulky, and old bronchoceles. His doses varied from somewhat less than a grain to somewhat more than a grain and a half. This was certainly, as Dr. Manson has suggested, too large a quantity of this powerful drug for the generality of patients. The management of the remedy is now better understood. I have never seen any of the unpleasant consequences enumerated by Dr. Coindet. These practitioners gave the iodine in the form of a tincture. But that is a bad mode of prescribing it: for the tincture is decomposed in any aqueous menstruum, and the iodine thrown down to the bottom. Under such circumstances the patient may at one time get no iodine at all, and at another time a dangerous dose: for you are aware that iodine is an active irritant poison. But if you mix iodine with iodide of potassium, it is then *held* in solution: and this is the form in which it is now commonly given. In the last edition of the British Pharmacopœia there is a *Liquor Iodi*, made by dissolving twenty grains of iodine, and thirty of the iodide of potassium, in an ounce of distilled water. This will doubtless, in future, be much prescribed. You may begin with five minims of this liquor, three times a day, and increase the quantity gradually, according as it is borne: for not only Dr. Manson, but Dr. Copland also, who states that the remedy has been very successful in his hands, advocates *small*, unirritating, what are sometimes called *alterative* doses. Simple friction is said to have had the effect of diminishing the tumour; and friction with some ointment or liniment containing iodine should be employed whenever the internal use of the remedy is contra-indicated; or *in addition* to its internal use. There is an authorised form for that purpose also in the Pharmacopœia —the *Unguentum Iodi*. A small portion of this may be rubbed upon the tumour night and morning. Or the tumour may be painted, night and morning, with the *Linimentum Iodi*, pauses being made whenever the soreness of the skin may require them. The liniment stains the surface of a deep orange colour, so that during this process the throat must be kept covered.

Dr. Maclean, writing from Indian experience, states that the *Unguentum Hydrargyri Iodidi rubri*, is remarkably efficacious in the removal of true goitre; and gives the following directions for its use:—'A portion about the size of a nutmeg is applied over the swelling with a smooth spatula. The patient is directed to expose his goitre to the sun's rays as long as he can bear the smarting which quickly follows. A second application is immediately made, and it rarely happens that any further treatment is necessary.' In this country the heat of a fire is to be substituted for that of an Indian sun.

Such is the best *medical* treatment of bronchocele; and such are the plans which you will always do well to make watchful trial of in the first instance. And with respect to surgical treatment, I may observe that so long as the disease is merely a deformity, so long as it does not interfere with any of the important functions of the body, nor produce serious discomfort—does not distress the respiration by pressing upon the trachea, nor impede deglutition by pressing upon the œsophagus, nor derange to any great degree the circulation through the head by pressing upon the great bloodvessels of the neck, nor grievously encumber the patient by its weight—we should not be justified (in my opinion) in performing or advising any surgical operation for the removal or the diminution of the tumour. Of such operations the three principal are, extirpation of the whole gland; the passing a seton through the tumour, and so exciting suppuration in it, whereby its substance is broken down and destroyed; and, tying the arteries which supply it with blood. The first of these methods, extirpation, has been performed when the wen was small; but few patients under such circumstances would consent to the operation; and few surgeons would now-a-days, I presume, advise or undertake it: and in cases where it might seem more expedient, that is, where the swelling is large, and suffocation is threatened by its pressure on the trachea, the execution of this measure would be exceedingly difficult and dangerous; for the arteries are so much dilated in these cases that perilous hæmorrhage might be expected from their division, especially when their close vicinity to the carotids is considered. Such large goitres come to involve also, by their lateral extension, very important nerves there situate. In one case where excision was attempted, the hæmorrhage was so alarming that the surgeon was obliged to desist in the middle of his task; and the patient actually died of hæmorrhage a few days afterwards. I believe that this operation may be said to be wholly abandoned by surgeons in the present day.

The introduction of a seton into the tumour has been more successful. This practice was revived about forty years ago by Dr. Quadri, of Naples; who supposed, indeed, that he had been the first to devise it. You will find an account of his mode of proceeding in the tenth volume of the 'Medico-Chirurgical Transactions,' by Dr. Somerville. The seton is passed through the substance of the gland, and retained there a considerable time; the chief caution necessary is to avoid the enlarged blood-vessels. Dr. Quadri affirms that the larger trunks of the thyreöid arteries will not be endangered unless the seton needle be passed so deeply as almost to touch the thyreöid cartilage; and that hæmorrhage from any of the branches of those arteries that may be wounded when the seton is inserted more superficially, will not be attended with hazard. This plan was followed in one case by ulceration and sloughing, and the patient died. An example of the success of this treatment occurred in the practice of Mr. James, of Exeter; the tumour was almost entirely removed, and the patient was for some time in London for the purpose of showing himself to the medical men here. But he also had passed through a good deal of suffering and of peril.

The expedient of tying one or more of the thyreöideal arteries, and so *starving* the tumour, has been attended with varied success. It has been done on the Continent, and several times in this country: there is a case of it by Mr. Coates, of

Salisbury, in the same volume of the 'Medico-Chirurgical Transactions.' His patient was much relieved for a time, and supposed herself cured. But the tumour gradually returned, and caused her death by suffocation. Sir Benjamin Brodie also performed a similar operation: and I have myself seen one very satisfactory instance of the same thing, the operation having been done by the late Mr. Earle in St. Bartholomew's Hospital. The patient was a young woman with an immense bronchocele, which for some time previously had obstructed her breathing, and of which the effect on the trachea seemed to be every day increasing. There was loud wheezing, and great difficulty of respiration, and cough, and extreme emaciation: and it was plain that the girl must soon die strangled if nothing were done for her relief. One of the arteries, I think the superior thyreöideal, was tied, without much difficulty, on one side. After the operation the tumour on that side shrank considerably; the distress of breathing was removed; and the patient presently recovered so much of her former strength, and flesh, and comfort, that she was unwilling to have anything more attempted, and left the hospital. After some time, however, she came back again of her own accord, and requested that the artery on the other side might be tied also. This was accordingly done, and a further reduction of the tumour took place. The shrinking, however, if I remember rightly, was not so striking or complete after the second operation as after the first: but the patient was certainly rescued, upon the whole, from imminent death, and put into a condition of ease and at least temporary safety; the tumour that remained constituting merely a deformity. I never heard of her afterwards. In a case very similar to this, related by Mr. Crawford in the 'Cyclopædia of Practical Medicine,' Mr. Wickham, of Winchester, tied one of the arteries, with much immediate, but no ultimate benefit. The goitre gradually diminished for about six weeks, and then (in consequence, I presume, of the establishment of a collateral arterial circulation) it as gradually enlarged again till it was as big as ever.

Of these surgical expedients there is not one, of which the *average* results have been sufficiently prosperous to warrant its repetition, except in cases where life is put in jeopardy or made miserable by the swelling; and where other methods, and particularly the treatment by iodine, have been tried, and have failed. One exception, perhaps, I should here make. The tumour sometimes evidently contains a quantity of fluid, either in one of its enlarged cells, or in a distinct cyst. Now the cell or cyst, may in such cases be punctured, and the contained fluid let out, without much risk. This was done in one instance by my colleague, Mr. Arnott. He kept the orifice open; and the cyst shrank, and was at last obliterated, and the woman was much gratified by this diminution of her load. I have since met with a precisely similar case.

A well-known and much respected Fellow of the College of Physicians, who has since died at the extreme age of 92, had long been embarrassed by a bulky enlargement of his thyreöid gland. One summer night, in Bruton Street, as he was walking home from a dinner party, he was operated on by a garotter, and left senseless on the pavement. A cyst contained in the enlarged gland broke under his assailant's grasp. Much inflammatory swelling followed this violence, and for a while the doctor's life seemed in some jeopardy. When, however, he at length recovered, he was able to congratulate himself that the villain, who had carried off his gold watch and gold spectacles, had relieved him of his goitre also.

There is a goitrous disorder very distinct and different from that of which I have hitherto spoken, and requiring a separate description. It is not, I think, a very common form of disorder. I, at least, in the course of a long and wide experience, have met with not more than four well-marked examples of it. It was first publicly noticed by Dr. Graves, in his 'Lectures,' in 1835; and it is therefore sometimes called 'Graves' Disease.' You will find it more fully considered in Dr. Stokes' volume on 'Diseases of the Heart and Aorta;' and by Trousseau in his 'Clinical Medicine.' An interesting paper on the subject by Dr. Cheadle, including the narration of seven cases, has just appeared in the fifth volume of the 'St. George's Hospital Reports.'

This disorder is characterised by the concurrence of three notable symptoms: throbbing of the heart and of the carotid and thyreöideal arteries—enlargement of the thyreöid gland—and prominence of the eyeballs. This last symptom is in typical cases so singular and startling as to arrest attention at once, and it has given occasion to the familiar name of the complaint, *Exophthalmic Goitre.*

The appearance presented by the prominent eyeballs is, as I have just said, most striking and peculiar. Both of them are always affected. They seem to be enlarged, though in reality they are not so, but simply pushed forwards. In extreme cases the bulging globes get beyond the enclosure of the lids, so that the eyes are never shut up. Even during sleep they look awake and staring. The white sclerotic is seen completely encircling the central cornea. The insertions of the recti muscles come into view, and are often marked by congested and varicose blood-vessels. Trousseau mentions a case in which the margins of the eyelids got behind the largest circumference of the eyeball, which had to be pushed back before they could be got into place again. The projection is caused by hyperæmia and congestion of the areolar and fatty tissues at the bottom of the orbit. When the congestion has been often repeated, or long kept up, those tissues are apt to become hypertrophied, and to prevent the repression of the eyeball into its socket. These conditions have been ascertained by examinations made after death.* The projecting eyes are movable and lustrous, and the patient's look is wild and strange. It is a remarkable circumstance that vision, in this disease, is scarcely at all interfered with, and that the uncovered conjunctiva does not suffer inflammation, as it is liable to do in cases of facial palsy.

All three of the symptoms become more pronounced under bodily exertion or mental excitement, and, in women, during the menstrual period.

The thyreöideal swelling never attains the enormous size, nor assumes the uncouth shapes, which are common in ordinary bronchocele. The right lobe is usually the most enlarged. The arteries of the gland, especially its inferior arteries, as well as the carotids from which they spring, throb strongly; and the superficial veins are often visibly turgid and prominent. You may sometimes—but not in all cases—feel a thrill, and hear a continuous bruit, like the placental souffle, in the gland itself, which expands a little, while the thrill and the bruit augment, with every pulsation of the heart. When the patient recovers, or the symptoms improve, the gland, though it gets less in bulk, does not generally recede quite into its natural dimensions, but becomes firmer from some interstitial deposit, the result of congestion long continued.

The goitre in these cases is not dependent on any influences of soil or climate.

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* And see, his face is black and full of blood,
His eyeballs farther out than when he lived,
Staring full ghastly, like a strangled man.

Shakspeare.—Henry IV.

Of the remaining one of the three characteristic symptoms, namely, the palpitation, it is to be observed that, though it is increased by bodily efforts and by mental emotion, it is at all times *persistent*; and that the heart's action, thus constantly forcible and frequent, is not necessarily associated with any organic disease of that organ. It cannot, I think, be doubted that of the three symptoms this is the first in the order of time; and it is probably, in some sort, the cause of the other two. The glandular enlargement and the protrusion of the eyeballs, taking place gradually, are not at first so open to notice as the cardiac and arterial throbbing. Instances have been noted in which the composite malady has been defective in one of the three factors; but the palpitation is never, I believe, absent. There may, as Dr. Cheadle remarks, be palpitation and exophthalmos only, there may be palpitation and bronchocele only, but bronchocele and exophthalmos do not occur together without palpitation. The throbbing is always the symptom first noticed by the patient.

Not only are the beats of the heart much more forcible, they are much more frequent also than is natural, exceeding, commonly, 100 in the minute; and in many instances, probably always, the pulse in the radial arteries is found to be feeble in comparison with that in the carotids.

As the large arteries of the body have no action of their own, the pulsation of the carotids and of their branches is simply a consequence and measure of the force and freedom with which the blood is delivered into them by the heart. It is there that the nervous spur which sets the whole agoing must have been applied; for it seems clear that it is some part of the nervous system which is primarily in fault. Various hypotheses have been broached—none of them satisfactory, and I refrain from enumerating them—in explanation of the observed phenomena. They appear, however, to be capable of explanation up to a certain point on the supposition that the minute muscular arteries—what Dr. Johnson calls the arterial stop-cocks—of the carotids and their branches are relaxed, in consequence of some paralysing influence exercised through the vaso-motor nerves. The blood will flow more freely in the direction in which there is the least opposing pressure; its very afflux would, as I have said, necessitate and account for the pulsation of the arteries; and the presumed relaxation of the minute muscular arteries might, perhaps, in some measure, account even for the increased action of the heart itself. But the admission of this conjectural explanation would leave the puzzle still unsolved. We do not perceive why or how the so-called paralysis of the vaso-motor nerves is brought about.

A vast majority of the patients are women—young women, between the period of puberty and twenty-five years of age—women suffering some kind of derangement or other of their uterine functions. Yet the disease can have no necessary dependence upon uterine disorder, since it occurs occasionally, in an unequivocal form, in men; and in women who have survived the child-bearing period. In one of Dr. Cheadle's cases the complaint dated from the cessation of the catamenia in a woman aged fifty-two.

Neither is the malady of anæmic origin, though sometimes allied with anæmia, for several of the carefully observed instances occurred in strong, well-nourished, florid persons.

Besides the triplet of symptoms that distinguish the disorder, there are others which are more or less observable in most instances: a change in the temper, which becomes capricious, irritable, and peevish; a disposition to flush under slight emotion; a tendency to epistaxis; a sense of heat in the parts supplied by the throbbing arteries; and profuse perspirations.

Exophthalmic goitre is not in itself a fatal disease. Recoveries are often made—even cures. The patients whom I have seen were mostly anæmic, and one of them certainly seemed to me to get better under preparations of iron. Dr. Begbie has described three instances of the occurrence of the disease with anæmia; one of the patients was cured, and the others were much benefited, by steel and a tonic regimen. Trousseau affirms, indeed, that the cases in which either iron or iodine proves useful are exceptional cases; that in general both these forms of medicine do harm. Yet two, at least, of Dr. Cheadle's patients prospered under long-continued courses of the tincture of iodine, and others took it without apparent detriment. There is more unanimity in favour of digitalis than of any other drug; and no one doubts now, I fancy, that digitalis carefully administered is often very efficacious in quieting excessive action of the heart.

LECTURE XXXIX.

Cynanche Parotidœa. Spontaneous Salivation. Aphthæ. Cynanche Tonsillaris.

THE Greek writers on medicine apply the terms *συναγχη* and *κυναγχη* to inflammatory affections occurring about the *throat*, and more or less interfering with the functions of respiration and deglutition: and the Latins employ the word *angina* in nearly the same sense. Cullen, in his Nosology, has made a *genus* of *Cynanche*, although the diseases which he has included in that genus have but little connexion, except that the parts they occupy lie *near* to each other. Some of them indeed have their seat in different, though almost contiguous, portions of the *same membrane*; and are apt, sometimes, on that account, to pass one into the other. In general they are allied rather by proximity of situation than by community of symptoms.

I mention these things, because there being a great disposition in the present day to *re-name* diseases, and to affect a more precise and scientific nomenclature than sufficed for Cullen, if I adopted the more modern appellations without adverting to the old ones, which have been current so many years, you might experience some difficulty, in your reading, in determining what disease was intended when it was merely *named*. For my own part, I think there is much inconvenience in altering the established nomenclature; and especially in changing such arbitrary terms as, though they may not be *scientific*, are yet *definite*, and convey no erroneous notions respecting the nature of the disorder. I shall give you, however, in most cases, both the old and the new denominations.

Now, one of the maladies in Dr. Cullen's genus Cynanche—though not the first in the order he follows—is *cynanche parotidœa*. It is an inflammatory affection of the salivary glands, and of the parotid gland in particular. Accordingly it is called *parotitis* now-a-days. It is not, however, mere inflammation of the parotid, arising from any cause whatever; and therefore parotitis, unless some epithet be added, is less exact than cynanche parotidœa. The vulgar have given it just as good an arbitrary name as the learned; and they call it in this country the *mumps*. With the Scotch it is, I believe, the *branks*.

This disorder need not detain us long. The parotid swells; tumefaction takes place beneath the ear; and if the submaxillary and sublingual glands are not implicated in the outset, they soon, in most instances, participate in the tumefaction; so that the swelling extends from beneath the ear along the neck, towards the chin, and also up the cheek, and the swelled parts are hot and painful, and very tender when touched. The aspect of the patient becomes curiously deformed. Sometimes one side only of the face is affected; sometimes both sides at once; but most commonly of all, first one side and then the other. These local symptoms are attended with slight fever. But the only function that is materially affected is the motion of the lower jaw, which is impeded and made painful by the swelling. The inflammatory condition almost always terminates after a few days, in resolution, under the use of moderate diet, and the application of external warmth. The disease reaches its height in about four days, and then begins to decline; and its whole duration may be computed, on an average, at eight or ten days.

This complaint often prevails epidemically: when it affects one person in a family, or school, it usually affects several others, simultaneously or in succession. It chiefly attacks children and young persons. There can be no doubt that it spreads by contagion; and it seldom happens that the same person is twice affected by the mumps. These are remarkable circumstances, and give the malady a peculiar and specific character. I do not dwell upon them now, because they belong also to a very interesting *group* of diseases, which will require to be particularly considered hereafter.

Another curious circumstance connected with the disease, and one which has some bearing upon its treatment, is that, in many cases, upon the subsidence of the swelling of the neck and throat, and particularly when it subsides *quickly*, the *testicles*, in the male sex, become swollen and tender, and the *mammæ* in the female. It is said, but I do not know whether the observation be constantly true, that the testicle, or the breast, of *the same side* with the inflamed parotid, suffers. Sometimes the testicle wastes away after the swelling recedes; a circumstance which is known occasionally to happen when inflammation of that part arises from other causes. This, however, is not usual. In general the inflammatory congestion subsides and ceases in the one gland as it does in the other; the swelling is neither very painful nor long continued. But sometimes a more serious transference takes place, from the testicle to the brain: this I have never witnessed; but then, to say the truth, I have not often been called upon to treat the mumps, and my personal experience of the disorder is limited. I find it stated that the metastasis to the testicle is considered as rather a fortunate circumstance, because it serves as a sort of protection against metastasis to the brain; but I suspect this to be a mistake. Some cerebral disturbance has been known to occur on the disappearance of the *parotid* swelling; but it has much oftener supervened, I believe, upon the retrocession of the inflammation from the *testicle* or *mamma.* It is said also that the inflammatory condition sometimes returns from the testicle to the parotid, and back again; oscillating thus two or three times between the two glands. Fortunately, the metastasis to the brain is much more rare than that to the testicle.

The treatment of the mumps is simple. It consists in the observance of the antiphlogistic regimen; mild diaphoretics; laxative medicines if the head should ache, or the bowels are confined; and warm fomentations, or dry warm flannel, to the neck and throat. The tendency observed in this complaint to a change of place—to metastasis to more important organs—forbids us from using very active measures to *check* or *subdue* the inflammation. Nor are such measures necessary. We are not to bleed, nor violently to purge such patients, nor to apply cold to reduce the swelling. Luckily hot applications are not only the most safe and proper, but the most grateful also to the feelings of the patient. If suppuration should ensue—which is unusual and unlikely, but which sometimes does occur from extension of the inflammation to the neighbouring areolar tissue—poultices should be substituted for the fomentations. Warm applications, and rest in the horizontal posture are to be recommended when the inflammation leaves the salivary glands, and attacks the testicle; or if the patient will not, or cannot, lie up, the testicle must be supported by a suspensory bandage—a bag truss. If the inflammation of the testicle or mamma be very violent, we must apply leeches, and afterwards poultices; but this will not often be required, or advisable. Finally, if the inflammation should fly to the brain, we must lay aside our previous caution, and treat the disease in that active manner which the inflammation of so important a part of the body demands. No *worse* metastasis *can* occur on the cessation of the encephalitis. I have fully spoken heretofore of the treatment to be pursued in that disease, and I have nothing to add respecting it now, except that it may be right, as an auxiliary expedient, to try to reproduce the inflammation in the parotid, or testicle, or mamma, by irritating applications—mustard poultices, for example—in the hope of thus producing what is called *revulsion*, and of diverting the disease from the brain to the part which it previously occupied.

You know that there is another specific form of *parotitis*, which is apt to be induced by mercury. Of this I have already spoken. When it is severe, it may be treated by leeches, without any dread of such metastasis as occurs in the mumps. It is usually, though not always, accompanied by a profuse discharge of the secretion proper to the glands affected; and it is attended also by sponginess and swelling of the gums.

I presume that when inflammation of these salivary glands is *not* attended with ptyalism, the parenchyma of the gland, or the areolar tissue which enters into its composition, is principally affected; and that when there *is* much salivation, the membrane lining the secretory and excretory ducts is implicated. We see the same distinctions in other analogous organs.

Profuse ptyalism sometimes occurs without any obvious cause; and is then said to be *idiopathic*, or spontaneous: and this is a circumstance which it concerns you to be aware of, both as practitioners, and as medical jurists. The same *tenderness and swelling* of the salivary glands, the same copious *secretion and excretion of saliva*, nay, even the same *fœtor*, or a smell which can scarcely be distinguished from it—the same collection of symptoms which is familiar to you as indicating the specific action of mercury upon the human system—will arise sometimes (but very rarely) when not a particle of mercury has been administered. Several other substances are well known to have the occasional effect of producing an increased, and even a profuse flow of saliva: preparations, for example, of gold, of copper, of antimony, and of arsenic. Castor oil is said to have sometimes the same consequence. Digitalis certainly has; and sometimes, I believe, opium. Now and then ptyalism is met with as a symptom, among others, of pregnancy. Occasionally it results from some local irritation within the mouth; from a decayed or misplaced tooth. But what I principally wish to call your attention to is the fact that *salivation* may occur as an *idiopathic complaint*. In the twenty-sixth volume of the 'London Medical and Physical Journal,' there is an instance of it described by Mr. Davies, in which two or three pints of saliva were discharged daily for some time. This flux at length ceased under the use of laxative medicines. In the second volume of the 'Transactions of the College of Physicians' is an extraordinary example of the same thing, related by Mr. Power. A young lady, of sixteen, spat from sixteen to fourteen ounces of saliva daily, for upwards of two years. Mr. Power believed that the ptyalism in this case was originally excited by wool, which he found, in a fœtid state, in her ears. In the 'Revue Médicale' there is an account given of a patient who was cured of a spontaneous ptyalism after spitting nine pints daily for nine years and a half. You may see another instance, as related by Dr. Prout, in the old series of the 'Annals of Philosophy.' Dr. Pereira states that he has seen a dozen such cases; and he describes one which was fatal, not from the ptyalism however, but from sloughing of the cheek: and this is no uncommon circumstance. In certain cases of idiopathic inflammation and ulceration of the gums or cheeks, from some constitutional unsoundness, there may be extensive sloughing, ptyalism, and a very offensive odour, much resembling that which mercury produces. I have met with but two examples of well-marked spontaneous ptyalism. Of one of these the circumstances were so peculiar that they may be worth relating. I was taken out to Bayswater, by a medical friend, in the beginning of the year 1833, to see a little girl, ten years old, who had been in a state of salivation from the 5th of November in the preceding year. Up to that time she had been a healthy lively child, with nothing very remarkable about her, except that she was habitually subject to profuse perspirations, which had a very acid smell: so that the washerwoman was always aware which were her clothes, when she came to wash them, by this *smell*. She then suddenly became indisposed, had a little headache, and began to spit a good deal. This was noticed by her mother, and pointed out to her medical attendant, before *any* medicine was given her; and mercury, on that account, was religiously withheld. But in spite of all treatment the ptyalism went on increasing. When I saw her she was spitting three pints of saliva in twelve hours: transparent, rather dark-coloured, and with a small quantity of foam on its surface. There was nothing amiss with her teeth, or her gums, and no fœtor of the breath. She was greatly emaciated, and resembled, in some respects, a person worn down by diabetes. From the very commencement of the spitting, the acid perspiration had ceased, and even the vapour bath failed to make her sweat. A great variety of remedies were tried, under Dr. Nevinson's superintendence, but without the least good effect. At last came the visitation of the influenza, in April of that year. The girl became severely affected by that disorder; and thereupon the salivation disappeared, and has not returned. I heard long after that she was in excellent health. The other case was that of a lady, aged forty-three, whom I saw in 1858 in consultation with the late Mr. N. Ward, the well-known inventor of the glass cases for ferns. For two or three months this lady had been spitting, daily, from a pint to a quart of saliva, having taken no medicine of any kind for eight or nine months previously. She had been an invalid for some years, without any discoverable organic or definite disease. Whenever the salivation diminished, the discharge of urine became troublesomely profuse. No benefit was obtained from washes of any kind; nor did any remedies that we employed do much or permanent good. Morphia reduced the amount of saliva, but was apt to make the patient sick. She had decayed teeth on both sides of her mouth. I could make out no other probable cause than this for the ptyalism. Her gums, however, were apparently sound.

Should you meet with cases of the same kind, you will search for some cause of irritation in the neighbourhood of the salivary glands, and especially in the state of the teeth and gums; and finding none, you will seek further for the cause of the salivation in some deviation from the natural condition of one or other of the principal functions of the system: and you will regulate your treatment accordingly. I do not know of any specific plan of cure to be recommended: but it is certainly of importance that you should be acquainted with the fact, that ptyalism sometimes exists as a separate and independent malady. Astringent washes are found, sometimes, of service: a solution of alum or of tannin, or the infusion of catechu, or a few drops of creasote suspended, by the help of mucilage, in water. A strong solution of chlorate of potass, made with boiling water, is also in repute as a wash, in this affection.

Before I proceed to the diseases pertaining to the interior of the fauces and throat, let me take this opportunity of saying a few words with respect to *aphthæ*. They form the characteristic symptom of an especial disease of infancy: and they are apt to occur in the course of other diseases in adult age; and are then of some importance as guides in forming our prognosis, and even in determining our plan of treatment.

Aphthæ consist in small, irregular, but usually roundish white specks, or patches, scattered over the surface of the tongue, and the lining membrane of the cavity of the mouth and fauces; the angles of the lips, the cheeks, the palate, the pendulous velum, the tonsils, the pharynx. They look like little drops of tallow, or morsels of curd, sprinkled over those parts; they project a little above the surrounding surface; and, in fact, they are mostly formed by elevated portions of the mucous epithelium, covering a small quantity of a serous or gelatinous fluid, which separates the epithelium from the subjacent membrane. These portions of the epithelium detach themselves, and fall off; leaving behind them a reddish raw-looking surface, or sometimes a foul and ash-coloured spot: and successive crops of these aphthæ are apt to be formed.

Now children in arms who exhibit these aphthæ, are said to have the *thrush*. This occurs at an early age; seldom or never, I believe, after the period of lactation is over. The spots occasion some inconvenience in themselves—the mouth is rendered hot and tender by them. The child may be eager enough to take the breast, but is observed to do so with pain and wailing whenever its mouth is applied to the nipple, and attempts to suck or to swallow are made.

But these aphthæ, thus occurring in infants, are attended with other symptoms of disorder; such as drowsiness, sickness, diarrhœa, and some feverishness. And a general notion prevails, I fancy, that the same aphthous condition which is visible in the tongue and mouth, pervades, in such cases, the whole of the alimentary canal. But this I believe to be a mistake. The complaint sometimes appears to be the result of improper diet, in children brought up by hand; or of milk of a bad quality, from an unhealthy or intemperate nurse. It generally lasts eight or ten days. It is not attended with much danger, except in certain cases, when the surface is left brown or bluish after the loosening and separation of the crusts. In such cases, the local affection is apt to run into a bad kind of gangrenous ulceration, and the discharges from the bowels become slimy and shreddy.

In almost all instances of the thrush in children, there is acidity of stomach present. Care, of course, is to be taken to discover and to correct any error of diet; and any unwholesomeness in the quality of the food. As an internal remedy the chlorate of potass is reckoned by some to have a specific virtue. I know of no form of medicine better adapted to redress the diarrhœa of infants than the powder which I have already mentioned, consisting of a quarter of a grain of calomel, two grains of the dried carbonate of soda, and three grains of prepared chalk. This may be repeated according to the circumstances of the particular case; and for the local affection of the tongue and mouth, the *glycerinum boracis* is a capital application. It may be painted on the aphthous parts with a camel's-hair pencil.

Aphthæ occurring in adults, in the course of other diseases, are often the harbingers of dissolution. They denote considerable *debility*; and they point out the propriety of sustaining the patient's strength by bark, wine, and nourishing food. It is remarkable how treatment of this kind will sometimes *tell.* I had a patient last summer who lived for some months, in tolerable comfort, after a second attack of apoplexy. Every now and then he would have a crop of aphthæ appear, which was always an admonition to us that he not only would bear, but that he required, some tonic. A more generous diet, with bark and chlorate of potass, would dissipate them in a day or two.

Borax is an excellent application for aphthæ, whether they occur in adults or in infants. I have known it afford great comfort to patients who were in the last stage of phthisis, and to whom the aphthous state of the mouth was a source of considerable distress. Equal parts of *mel boracis* and of syrup of poppies make a good form. Or an agreeable as well as useful gargle may be made by mixing two drachms of borax with an ounce of glycerine and nine ounces of water.

In some, and in some only, of these cases, upon the white aphthous patches the microscope can detect the growth of a minute cryptogamic plant, the *oïdium albicans.* You must not fall into the mistake of regarding this epiphyte as the cause or essence of the complaint; it is simply one of its accidents. The minute spores of this kind of fungus find in the diseased spots a congenial soil, in which they settle and germinate; like the mould upon a decaying cheese. The spots thus overgrown may be presently swept away by a lotion consisting of the sulphite of soda dissolved in water, in the proportion of a scruple to a fluid ounce. The theory of its efficacy is that the acid secretions of the mouth decompose the alkaline salt, and the resulting sulphurous acid kills the vegetable parasite.

Aphthæ seem sometimes to depend upon mere derangement of the stomach. A nobleman who when alive was well known as a *bon vivant*, could never eat shell-fish (so I was told by his physician) without finding, within two hours, that his mouth was full of aphthæ. Even lobster-sauce would serve him thus. I look upon this as a sort of internal urticaria.

Hard by the salivary glands lie the tonsils: and one of Cullen's species of cynanche is the *cynanche tonsillaris*: in more modern language, tonsillitis, or amygdalitis; or, in the vernacular, quinsy, common inflammatory sore-throat: a disease which, though internal, is yet within the reach of our sight, and easily recognised.

The popular term quinsy is in truth traceable—through the French *esquinancie*—to the scientific term cynanche.

This common and troublesome disorder occurs with very unequal severity in different cases. The differences depend upon the extent of the disease, and upon the number and variety of the parts which it involves: for it is seldom limited entirely to the tonsils, but spreads to the uvula, the velum palati, the salivary glands, the pharynx, and even to the root of the tongue, and the neighbouring areolar tissue. When the inflammation is superficial it does not produce any great distress, even though it may be diffused. When it penetrates through and beyond the mucous membrane, it is apt to end in suppuration, and to harass the patient much: the tonsils swell to an enormous size, and at length deep abscesses form in them. The disease is worst of all when the back part of the tongue, and the muscular and areolar tissues thereabouts, become implicated: it may chance to reach even the larynx, and then it is always attended with peril.

Under its more ordinary form, cynanche tonsillaris generally manifests itself, at first, by a slight degree of uneasiness and difficulty in swallowing; with a constant dryness and sense of constriction in the fauces, and a feeling as if some foreign substance were sticking there. Upon inspecting the throat, more or less of inflammatory redness and swelling is seen of one or both of the tonsils. Sometimes both of them are affected at once. Very frequently one only is first attacked: and the swelling begins in the other as it subsides in the first. This is just what occurs in many instances also of cynanche parotidœa. The uvula is commonly enlarged and elongated, and of a scarlet colour. Sometimes it drags upon the back part of the tongue, or dangles into the pharynx, causing the disagreeable sensation of a foreign body continually present, and provoking, by its mere contact, painful and fatiguing acts of deglutition. More frequently the uvula may be seen to be adherent to that tonsil which is most swollen. The dryness of the fauces soon gives place to a copious secretion of transparent mucus, which is frothy and viscid, and sticks to the inflamed surface, so as to be detached with difficulty; and the patient is tormented by continual and painful efforts to hawk up or to swallow this mucus. In an early stage of the disease opaque whitish or yellowish patches appear upon the red tonsil. These consist of the altered mucous secretion of the inflamed surface, or of the discharged contents of its mucous crypts. It is important that you should be aware of this, lest you mistake such specks for ulcerating or sloughing points, or for membranous exudations, such as occur in certain other affections of the throat, but are not common in this.

When the inflammation is violent, the submaxillary and parotid glands sometimes swell, and become tender on pressure; and, less frequently, the patient is troubled by profuse ptyalism. In other words, the inflammation spreads from the tonsils to the salivary glands, and secondary parotitis occurs; sometimes with and sometimes without an augmentation of their natural secretion. Unable, or unwilling, to swallow the abundant saliva, the patient allows it to dribble from his mouth.

Now and then, although the act of swallowing is difficult and painful, you perceive, on looking into the fauces, no appearance which can account for these symptoms. The inflammation is seated lower down in the throat, out of sight. This cannot with propriety be called cynanche tonsillaris; indeed, it forms a distinct species, the *cynanche pharyngea* of Cullen. I mention it here because it really does not require any separate consideration.

The pain in cynanche tonsillaris is felt almost solely during the act of deglutition; which is difficult also from the mechanical narrowing of the passage by the enlarged glands. When both tonsils are affected at once, and much swollen, they push forwards the anterior pillars of the velum palati, and the uvula, and project in the shape of two great balls of flesh, into the arch of the fauces, so as to leave a very small space only between them; and they sometimes even meet and touch each other, and suffer ulceration from their mutual pressure. When attempts are made to swallow liquids, these are apt to return through the nose; the backward passage can no longer be shut, in consequence of the tumid and fixed condition of the velum palati. The patients are unable to swallow even soft solids; indeed the pain of swallowing is so great, that they are not easily persuaded to try. In severe cases pain shoots from the throat to the ear along the course of the eustachian tube; and this is considered important, as being indicative of suppuration. I believe that suppuration does occur in the majority of the cases which are attended with this symptom. Sometimes there is tinnitus aurium and partial deafness, from the obstruction produced to the passage of air through the eustachian tube; either by closure of its extremity in consequence of the swollen state of the parts about it, or by some thickening of its lining membrane from an extension of the inflammation along its channel.

When the inflammation is intense, and involves the root of the tongue, the patient becomes unable to open his mouth sufficiently to allow the fauces to be seen; and the inflamed parts can be examined only by means of one's finger. In some instances the power of separating the jaws is so limited as not to permit the introduction of the finger, and the tongue is incapable of any motion.

In ordinary cases, however severe the disease may be, there is scarcely any affection of the breathing. But the throat is so blocked up, and the free play of the velum palati so hindered, that the speech is altered, becoming thick, guttural, and inarticulate. You may often recognise the disease by the peculiar sound of the patient's voice, without looking into his throat. When the swelling of the tonsils is very great, the breathing does sometimes become impeded; and it is in such cases alone, or *nearly* in such cases alone, that this disease is at all alarming.

Cynanche tonsillaris is commonly attended, from the very outset of the inflammation, by smart inflammatory fever, severe headache often, and a rapid pulse, rising to 120 beats in the minute, or more. The constitutional disturbance runs higher than we might have expected, considering the limited extent of the local inflammation, and the comparatively small importance of the part inflamed. At the same time there is very little of that debility and anxiety which are observed, as we shall see hereafter, in the specific continued fevers.

The inflammation does sometimes, I believe, terminate by resolution: but when it is violent or long-continued, it most frequently leads to the formation of pus. When the mucous secretion increases in quantity, and becomes less viscid, while the difficulty of swallowing diminishes, and the febrile symptoms decline, resolution may be hoped for. Suppuration, on the other hand, may be expected when the inflammation is unusually intense; when, by the swelling of the tonsils, the breathing is impeded; when a pulsating pain is felt, shooting to the ear; when the patient can scarcely open his mouth, or protrude or move his tongue, or turn his head; when there is more than usual *external* swelling; and when the symptoms increase, or even fail to remit, after five or six days have elapsed. Rigors sometimes accompany and announce the suppuration; and afterwards the pus often may be seen shining through the membrane covering the tonsils: or the finger may ascertain the presence of matter, by the softness and elasticity of the swollen tonsil. In many cases, however, it lies so deep that it cannot be detected by the most careful examination. At length the little abscess bursts; and the relief thereupon experienced by the patient is sudden and striking. All at once the pain ceases; he can swallow, and he feels himself well; and often indeed he is well, or nearly so. The matter discharged has always a nauseous taste and a remarkably fœtid smell; and sometimes the fœtor, or the ill taste, is the only sign, besides the improvement in the symptoms, that indicates the rupture of the abscess; the pus being so small in quantity as, when mixed up with other matters, easily to escape notice; or (what frequently happens), passing backwards into the stomach under an involuntary movement of deglutition. Suppuration sometimes, but rarely, takes place externally, in the areolar tissue of the neck, as well as internally.

The termination in gangrene is spoken of in books, and it is just possible; but it never happens, I imagine, except in unhealthy constitutions, or when tonsillitis occurs as a complication of more general disease, such as scarlet fever. It is much more common to see repeated attacks of cynanche tonsillaris produce what used to be absurdly called scirrhus, a permanent enlargement and hardening of the tonsils. While they are in this state, a low kind of inflammation is very readily re-excited in them. The surface of the enlarged tonsils is generally irregular and notched, something like that of a walnut-shell; and a white or yellow secretion is often to be seen lying in the hollows. This appearance may easily be mistaken, by an inexperienced eye, for ulceration.

There is not much risk of your confounding cynanche tonsillaris with any other complaint. The various species of cynanche enumerated by Cullen are separated each from the others by certain broad lines of distinction, all derived, however, from different combinations of two symptoms—*dyspnœa* and *dysphagia*. Thus, in cynanche tonsillaris, deglutition alone is difficult; and when you look into the throat, you see at once why it is difficult. There is equal difficulty of swallowing, and equal freedom of respiration, in cynanche *pharyngea*: but the cause of the dysphagia is not visible. In cynanche *laryngea* both functions are implicated; there is difficulty of swallowing as well as difficulty of breathing. Cynanche *parotidœa* is distinguished by the *absence* of both the symptoms; its title to the name of cynanche is therefore equivocal. Many of these points will soon come under our notice again.

Cynanche tonsillaris is supposed to be most frequent among the young and plethoric. But it certainly occurs very often also in persons who are pale, and spare, and feeble; and in those of middle age. Some individuals appear to have, by nature, a strong predisposition to the disease; and in them its attacks are more or less periodical; recurring at particular seasons, and commonly during the variable weather of spring and autumn. The peculiarity runs sometimes in families. The liability to the complaint is also very much increased by repetitions of the attacks.

The only exciting cause worth mentioning, almost the sole cause indeed, is exposure to cold. Not unfrequently it assails so many persons at the same time as to be epidemic; and for that reason it has sometimes been thought contagious. But it has no contagious property whatever. Although we often see several members of the same family affected by it at once, yet we may learn, upon careful enquiry, that its commencement in the different cases has been too nearly simultaneous to admit the supposition of its having been communicated from one to another. The patients have all been exposed to the same unwholesome influences, which operating upon similar constitutions, such as those who are sprung from the same parents may be expected to possess, have produced similar effects. This prevalence of the disorder at certain times and places, is connected, no doubt, with some peculiar conditions of the atmosphere.

The prognosis is almost always favourable. Not but what death may be produced by this disease, under peculiar circumstances, and when the inflammation is unusually violent and extensive. The late Dr. Gregory, of Edinburgh, used to mention in his lectures one instance, the only one he had met with among many hundred cases, of death from cynanche tonsillaris. He did not see the patient till he was moribund; and he suspected that it was combined with typhus fever. Trousseau declares that, 'during his very long medical life he had never known death to occur from this malady.' The only fatal case that I ever witnessed occurred some years ago at the Middlesex Hospital, in one of my own patients. He was a stout young man, 26 years old, a private coachman. The complaint was clearly traced to his having got wet through, more than once, a day or two before it came on. Besides the ordinary symptoms of cynanche tonsillaris, there was great external swelling on both sides of the throat, and the patient was unable either to open his mouth or to move his tongue. The inflammation involved not the tonsils merely, but the base of the tongue, the salivary glands, and the surrounding areolar tissue. At length suppuration took place. The abscess broke internally, and pointed also externally, just below the symphysis of the chin, where it was opened with a lancet. Two days after, there was a sudden gush of blood from the mouth. So immovable were his jaws that it was impossible to determine from which side the hæmorrhage proceeded; it was stopped, however, apparently by the treatment adopted. A fortnight later, the bleeding recurred profusely. It was now evident that the blood was arterial, and that it came from the left side of the throat. Preparations were made for tying the common carotid on the left side; but just as the operation was about to be begun, the patient expired in our presence. His death was shocking, but full of pathological interest. He did not sink, as you may have supposed, in the way of syncope, from loss of blood; but by suffocation. The blood passed down the trachea and into the lungs; and he had been so weakened by the previous hæmorrhage, that he could not expel the blood thus introduced, which actually choked him. A large clot was afterwards found, filling up the wind-pipe. I felt this man's pulse beat firmly and regularly, for a minute perhaps, after his last effort to breathe. On examining the body, it was discovered that the abscess had opened internally, behind and below the left tonsil. The lingual branch of the carotid artery crossed the site of the abscess, and had been severed and laid open by ulceration. From this vessel the fatal hæmorrhage had come.

It should be borne in mind also that cynanche tonsillaris does sometimes, by extension of the inflammation to the neighbouring parts, superinduce that very formidable species of cynanche of which I am soon to speak, the *cynanche laryngea.* All cases in which the *breathing* is in any degree affected should excite suspicion and strict scrutiny; although the dyspnœa may be produced by the mere swelling of the tonsils.

You will understand, then, that cynanche tonsillaris *may*, under unusual and untoward circumstances, prove a fatal disease; but that it is so very rarely indeed. In almost all cases we may say that the life of the patient is not in danger.

In the uncomplicated and milder form of the disease, when the inflammation is superficial and the fever slight, no great activity of *treatment* is requisite. The patient should be kept within doors, and even in bed; for a troublesome tendency to a recurrence of the disorder may be fostered by neglect or imprudence. Cooling saline purgatives will be proper, and what is called a *slop* diet. A strip of flannel may be put round the neck, or linseed meal poultices may be applied to the exterior of the throat, beneath the ramus of the jaw: not that the inflammation will be put a stop to by these means; but they are comforting to the patient, and likely to help the complaint to run its course evenly, and to end in resolution, in a few days. Commonly, it is not completely over until both the tonsils have been attacked in succession.

When you catch the disorder in its very outset, I believe you may sometimes succeed in cutting it short by an emetic: a scruple of ipecacuan, for example, with a grain of tartarised antimony. In all cases it is right to administer a brisk purgative.

A great variety of astringent, acid, and other gargles have been employed in this disease; and their good effects have, I apprehend, been much over-rated. Many cases would do quite as well, or better, without them; for in the early stages strong astringents, and the straining and movements of the throat that accompany their use, may even be hurtful, and increase the pain and the inflammation. The only gargle which I should consider admissible in the commencement of the malady is a gargle of warm milk and water. I have known of one instance in which quinsy suddenly attacked a gentleman who was extremely anxious to use his throat, in public speaking, the next day. He occupied himself perpetually for some hours in this sort of fomentation of the tonsils with hot water, and with such good effect that on the day following he was able to accomplish his object. Still there are cases in which, at certain stages of the disease, detergent gargles are serviceable, by assisting the excretion of the mucus that collects in the fauces, and by correcting fœtor. A weak solution of chlorine in water answers well. In more chronic sore throats, stimulating gargles may often be employed with advantage. When the inflammation is violent, a slightly stimulant linctus is preferable; it *cuts the phlegm* as they say, i.e. it promotes its detachment and removal. Of this kind, currant jelly is one of the best.

But far better than anything else, as a local application to the inflamed fauces, is the steam of hot water, whether we are hoping for resolution of the inflammation, or whether we desire to promote and hasten the process of suppuration already begun. One of the best instruments that I know of for inhaling the steam is that which is called 'Nelson's.' It is convenient, effectual, and cheap.

Blistering the outside of the throat is a favourite remedy with some, who think that, when early applied, a blister may do good by preventing suppuration. Trousseau, however, maintains that all medication in this complaint is useless; and Dr. Jackson, of Boston, in his 'Letters to a Young Physician,' avows the following strong opinion:—'When you see the disease at an early period, you may very naturally think of the remedies proper for inducing resolution, such as leeches and vesication. Now I wish to express to you my conviction that in these cases suppuration cannot be prevented by any treatment.' Without going quite this length, I must say that I should avoid blisters. They are at least of uncertain efficacy; and they leave a mark which lasts for some time, and which patients of the other sex are apt to complain of. In very severe cases, leeches applied to the upper part of the throat, just below the angles of the jaws, have been found to mitigate very sensibly the patient's distress.

I have already admonished you to make a careful examination of the throat, and to watch your patient narrowly, whenever he experiences any difficulty of breathing. Dyspnœa may be produced by the mere swelling of the inflamed part; and when it concurs with much enlargement of the tonsils you had better pierce them with a lancet. If they contain matter, it will be evacuated: and if not, the bleeding produced by the puncture will generally reduce the swelling somewhat, and relieve the patient. There is an instrument made on purpose for this small operation, consisting of a lancet enclosed in a flat silver sheath, from the end of which it is made to protrude, to a certain extent only, by pressing upon a spring. The instrument should be directed towards the centre of the fauces, and not outwards; in order to avoid wounding important vessels or nerves. Dr. Cullen indeed says, 'This does not require much caution;' but notwithstanding this high authority, I must warn you that puncturing or scarifying the tonsils is an operation not to be carelessly, or rashly, or wantonly performed. Portal mentions a case in which a skilful surgeon in scarifying the tonsil of his patient, wounded, as he supposes, some ramification of the internal carotid, and the patient was presently dead. That artery lies, as you know, very near the tonsil; and only a few years ago, in Ireland, it was struck by a surgeon while scarifying a gentleman's tonsil; and the gentleman died in three minutes. This I was told by the late Dr. Barclay. The case I related just now of fatal hæmorrhage from the lingual artery points to the same danger; and since that case occurred two others involving similar hazard have fallen under my own notice, and impressed me with a strong feeling of the necessity of caution. A man was brought into the hospital with profuse hæmorrhage from the right tonsil or its immediate neighbourhood, the consequence of syphilitic ulceration of those parts. He had lost three or four quarts of blood and was nearly dead. His life was saved by Mr. Mayo, who tied the common carotid on that side.

Last February (1838) a boy, from Harrow School, was placed under my care, in whom cynanche tonsillaris came on during convalescence from scarlet fever. So much swelling was there of both tonsils that they met, and pushed the uvula outwards before them, and the breathing was much impeded. A surgeon who was in attendance with me punctured the tonsils. The next day a good deal of hæmorrhage took place; and this recurred several times, to a considerable and even an alarming amount. When the clots that formed were wiped away with a sponge, the blood could be seen welling out in a little stream, with a pulsating motion, from a small incision in the left tonsil. After much trouble and anxiety, the hæmorrhage was ultimately arrested, by applying a pencil of lunar caustic freely within the bleeding orifice. Lint, wetted with the muriated tincture of iron, or with a saturated solution of alum, or with a strong solution of tannic acid, is a fit application in similar accidents.

Mr. Lawrence, who saw this case, told me that he once knew a patient die of hæmorrhage from the tonsillar artery. In a case of recurring hæmorrhage from a punctured tonsil, Mr. Stanley tied the common carotid. Two months afterwards, the patient died of softening of the brain.

I ought, perhaps, here to add, that Mr. Joseph Bell, of Barrhead, has strongly recommended the internal administration of powdered guaiacum, in large doses, as being almost specific in the cure of cynanche tonsillaris. He gives as much as half a drachm, suspended by means of mucilage in a draught, every six hours. Mr. Bell has no doubt that this remedy, if timely administered, will cut the disease short in ninety-nine cases out of a hundred. It has been thought successful in other hands also. I have never had an opportunity of trying it; and I think it not improbable that the sore throats thus cured have been of that naturally transient kind which Trousseau has described as the *rheumatic sore throat.*

The chronic enlargement of the tonsils, to which I have already adverted, is sometimes productive of great inconvenience and distress, and even of danger. Its ordinary consequences are—habitual trouble in swallowing; confused and inarticulate speech; deafness in various degrees, from occlusion of the eustachian tubes; more or less impediment of breathing; and even spasm of the glottis, and impending suffocation. The enlargement may in such cases be somewhat reduced, I believe, by painting them repeatedly with the *Linimentum Iodi*; or by applying a pointed stick of lunar caustic to two or three spots on their surface daily, whereby a number of little cicatrices, and corresponding areas of contraction, are produced: but a much readier and a preferable plan is to amputate them, in part at least. This may be done by a ligature; or still better by scissors, or by a sort of small guillotine invented for that purpose. It is not a very painful operation. Mr. Arnott removed one lately from one of my hospital patients; and but a very few days ago (December, 1838) Mr. Mayo brought two, in a piece of paper, to the hospital. He had just before cut them off for a patient whose respiration they had much embarrassed.

For many years after my professional life began, our means of ascertaining the nature of deep-seated affections of the interior of the throat were very limited. The tonsils, indeed, we could see; the larynx was thought to be beyond our ken. But it was within the reach of one's finger, and a little practice enabled the physician or surgeon to familiarise his sense of touch with the ordinary condition of the upper part of the respiratory apparatus, and so to detect swelling, or irregularity, or permanent thickening, about the chink of the glottis. And great advantage was sometimes derived from the direct application of remedies to the invisible diseased or over-sensitive membrane. The late Mr. Vance was in high repute for his skill in treating throat diseases in that way. Having been for many years a surgeon in the navy, he called his procedure, in naval phrase, a *swabbing* of the affected part. A small piece of sponge, secured with a string, or fastened to the end of a finger of a glove, was dipped in a strong solution of nitrate of silver, and then carried deep into the throat, as far as that spasmodic state of the muscles which the attempt produced would permit, and pressed downwards upon the upper surface of the larynx. But though benefit was sometimes obtained, and cases of chronic hoarseness, loss of voice, or cough were thus occasionally cured, the process was often useless, if not injurious. With our present methods of examination, we know that this blind swabbing must in many cases have been ludicrous as a remedial effort; for we are now enabled to *see* these parts, and to direct our remedies with intelligent aim and purpose. I cannot here go minutely into the history of the *Laryngoscope*: this much, however, I may say, that our countryman, Dr. Guy Babington, must in all fairness be pronounced its practical inventor, while the still greater credit of having simplified the instrument, and made it easy of application, and brought it into general use, must be awarded to M. Czermak, who demonstrated here, and elsewhere in Europe, upon his own person, the facility with which the vocal cords in the one direction, and the back part of the nasal cavities in the other, can be brought into distinct view, and their condition and movements clearly perceived.

It deserves, however, to be recorded, that M. Garcia, the eminent singing-master, prompted by a praiseworthy and intelligent curiosity to investigate the mechanism of the voice in its living play, was the first to contrive *to see his own larynx*: and it was the publication (in the 'Transactions of the Royal Society for 1855') of the results of his ingenuity that led the German physicians to take up the subject.

The inspection is made by means of a mirror, which reflects the parts inspected. For a detailed description of the apparatus employed, and of the best means of employing it, I cannot refer you to any better authority than to two lectures on the subject, which were read before the College of Physicians, in

1864, by Dr. George Johnson. And I very earnestly advise you to neglect no opportunity of acquiring facility and dexterity in the use of the laryngoscope, by practising upon your own throat, and upon those of your fellow-students, before you have occasion to seek its guidance in the treatment of disease. The knack of using the instrument is very easily learned. Every practitioner throughout the kingdom ought to possess a laryngoscope, and to be master of its familiar application. It would be a shame and sin if this invention, which may be made so widely fertile of good, should be perverted into a pretext for erecting among us a new and pernicious 'speciality.'

LECTURE XL.

Acute Laryngitis. Symptoms. Treatment; Blood-letting. Tracheotomy, Mercury, Diaphoretics. Causes. Secondary Laryngitis. Œdema of the Glottis. Infantile Laryngitis, or Inflammatory Croup. Diphtheria. Child-crowing. Chronic Affections of the Larynx.

The disease of which I have next to speak is of a character far more serious than those which were considered in the last lecture. *Cynanche laryngea*, or acute and severe laryngitis, has proved rapidly fatal in a large proportion of the instances in which it has been known to occur. Yet when the patient is seen tolerably early, and the nature of the malady is clearly perceived, and the source of peril thoroughly understood, I believe that our art is sufficient, in most cases, to rescue the sufferer from the fate that threatens him. It is of the greatest importance, therefore, that you should be able to recognise laryngitis when you meet with it, and that you should comprehend the principles according to which it requires to be treated.

What is laryngitis? It consists, as the term implies, in inflammation of the parts composing the larynx; and especially of the mucous membrane that covers the laryngeal cartilages, including the epiglottis. The inflammation may be, and sometimes is, exactly limited to the larynx; but frequently it extends also to the posterior fauces, the velum palati, and the tonsils.

Now, laryngitis varies much in respect of its violence and intensity. In a great majority of cases it is unattended with any peril to life. It forms, for instance, a part of every attack of ordinary catarrh accompanied by hoarseness; but sometimes the inflammation is intense, and concentrates itself upon the larynx and the parts immediately contiguous to the larynx, and then it is apt to assume a most dangerous character.

The *symptoms* of acute and severe inflammation of the larynx are these. The patient complains of *sore-throat*. If you look into his throat you will commonly perceive some redness of the velum and uvula, and of the fauces generally. But there is a degree of restlessness and anxiety about the patient more than proportionate to the apparent inflammation. Occasionally among the earliest of the symptoms that bespeak danger, and ought to excite alarm, is *difficulty of swallowing*, for which no adequate cause is visible in the fauces; and to this is presently added *difficulty of breathing*, for which no adequate cause can be discovered in the thorax. The mode and character of the respiration are peculiar; it is attended with a throttling noise; the act of inspiring is protracted and wheezing, as though the air were drawn in through a dry narrow reed. If you ask the patient what is the *seat* of his distress, *where* the disease is situated, he points with his finger to the *pomum Adami*. If he cough, he coughs with a peculiarly harsh, and stridulous, or else with a husky, abortive sound. He either speaks quite hoarsely, or all power of audible voice in the larynx is lost, and he speaks by means of his lips and tongue only, in a whisper. There is tenderness of the laryngeal cartilages; they are painful when pressed externally. The face is flushed; the skin hot and dry; the pulse hard. As the disorder advances, the patient's general distress increases: but some of the symptoms alter: his countenance becomes pale or livid, anxious and ghastly; his eyes protrude; he is miserably unquiet, impatient for some relief, declares or makes signs that he wants air, and begs that the windows may be opened; and if he does not *obtain* timely relief, he perishes—he dies choked.

The pathology of this terrible disease is extremely simple. The membrane covering the interior surface of the instrument of the voice suffers inflammation. One effect of inflammation in mucous membranes is a thickening of those membranes; they become turgid, red, and swollen. Another frequent effect is the effusion of serous fluid in the subjacent areolar tissue. By such tumid thickening of its lining membrane, the chink called the *rima glottidis* is narrowed: it is still further diminished in breadth whenever the membrane is lifted and protruded by infiltration of the tissue beneath it: it is so nearly closed up, that air cannot pass inwards in sufficient quantity to sustain the vital functions: a small portion only of the blood returned to the lungs from the right side of the heart undergoes the requisite change from venous to arterial. The miserable patient grows drowsy and delirious, and dies by a slow process of choking. If the rima glottidis become *quite* closed up, his sufferings and his life are quickly at an end.

This disease affords a good instance of a truth which was announced in a former part of this course of lectures; viz., that the *danger* of a morbid change may depend entirely upon its situation. It is so, eminently, with laryngitis. The inflammation is sometimes limited to a spot of membrane not bigger than a square inch. If a square inch and no more of the same membrane, a little lower down, in the trachea, were inflamed in the same manner and degree, the complaint would be quite unimportant. Cynanche laryngea derives all its peril from the circumstance that the inflammation tends to shut up what may be called the *janua vitæ.* The part affected subserves two purposes; it is the organ of speech; and it forms a portion of the channel through which air is conveyed from without into the lungs. Both of these purposes are hampered in laryngitis. Now the animal function of speech may be entirely and permanently suspended without any danger to life. The function of respiration, which, though under the influence of the will, is an organic function, will not bear to be *suspended*, even for a few minutes; and life cannot be *long* sustained when it is *much impeded.*

The difficulty of swallowing is a remarkable symptom, but it is not always present. It doubtless results in some measure from the tumid, inflamed, and tender state of the membrane which is common to the pharynx and to the back part of the larynx, at the boundary line between the two, and which is pressed upon as the larynx rises in the act of deglutition. But this symptom may depend also, and in a greater measure, upon the state of the epiglottis, which is often enlarged, and fixed by the swelling in an erect position, and unable to execute its natural valvular office: so that when the patient makes efforts to swallow, a portion of the food or drink gets into the larynx, and a paroxysm of choking dyspnœa ensues. By pressing down the back part of the patient's tongue, and getting him at the same moment to make a coughing effort, you may sometimes obtain a sight of the tumid, red, and upright valve; or you may always see it by help of the laryngoscope.

The dyspnœa is constant: yet there are pauses of comparative ease and quiet; and there are, commonly, periods of severe aggravation and urgent distress. It seems that the permanent narrowing of the chink by the inflammation and its consequences, is from time to time increased by a spasmodic contraction of the muscles that close the glottis.

This is the first disease that has come before us, in which the respiration has been *primarily* hindered. If you call to mind what was stated in one of the early lectures respecting death by apnœa, you will be at no loss to understand the manner in which life is destroyed in laryngitis.

This formidable malady has always existed; for you may trace examples of it, under various names, even in the writings of the ancients. But it is only in comparatively recent times that it has been singled out from the rest of the anginæ, and made a separate object of study. It has numbered some distinguished medical men among its victims: Dr. David Pitcairn, Sir John Macnamara Hayes, Sir George Tuthill. The celebrated General Washington died of it. When it has caused death it has generally run a rapid course, and proved fatal before the fifth day. It *has* carried the patient off in less than twelve hours.

It is of the utmost consequence to make an accurate diagnosis. Laryngitis is easily distinguished from cynanche tonsillaris by the extreme and peculiar dyspnœa which attends it. There may be difficulty of breathing in the latter disease, from enormous swelling of the tonsils; but then such swelling will mostly be *visible*. In laryngitis the marks of inflammation to be *seen* on inspection of the fauces are generally slight and trifling, and quite inadequate to explain the difficulty of swallowing. Do not, however, forget that laryngitis may *supervene* upon cynanche tonsillaris. Again, cynanche laryngea is readily discriminated from cynanche pharyngea; in which complaint there is great pain and difficulty in deglutition; but the breathing is quite free.

What is to be done for a patient labouring under acute laryngitis? How and when are we to employ the great remedy for acute inflammation—the abstraction of blood from the inflamed part? or are we to employ it at all? These are points concerning which it is quite necessary that your minds should be prepared and prompt to decide. If you look merely to the results in the recorded cases of this fearful complaint, you will scarcely find an answer to the question. In some of them copious bleeding appeared to save the patients; in others, it was of no service, but rather seemed to accelerate their death. Sir John Macnamara Hayes suffered two attacks of cynanche laryngea. In the first he was freely bled. Dr. Roberts, of Bishop Stortford, informs us that the first bleeding was attended with *considerable relief*; the second also with *manifest advantage*; and by the third, *his safety appeared to be insured*. Fifteen years afterwards he died of the same disorder, for which he was again bled and leeched, under the care of Dr. Matthew Baillie.

Washington was largely bled and died. Again, Dr. Francis, of New York, recovered from acute laryngitis after copious venæsection, and still survives, enjoying a well-won reputation in that city. It is evidently needful to consider and determine the circumstances under which we are to use, or to withhold, this important remedy.

Any kind of bleeding, to be serviceable or safe, must be performed *early*. There is, perhaps, no disease in which the *καιρος οξυς*, the fleeting opportunity, is more conspicuous than in this. When I say that you must bleed early if at all, I do not mean that you are to reckon so many days or hours from the commencement of the disorder; but you must ascertain what progress it has made; for it travels sometimes at a railroad pace. You must look to your patient's actual condition; and I apprehend that your practice with respect to blood-letting may be safely guided by the following rules. When there is high inflammatory fever present, and the skin is hot, the pulse firm and full, and the cheeks are red, and the lips florid, you may take blood locally from your patient with decision and advantage. But if his powers are beginning to sink under the poisonous influence of imperfectly aërated blood, or from pulmonary congestion; if his skin be cold, or even cool, his face pale or leaden, his lips blue, his pulse small and feeble, his mind wavering, you will do no good by blood-letting: nay, you will increase the danger which already exists, and hasten the fatal catastrophe.

With regard to local blood-letting, and to counter-irritation, there is one remark made by the late Dr. Farre of much practical importance. It is a common practice in affections of the throat, to apply leeches over or near the laryngeal cartilages, and afterwards to place a blister there. Now serous infiltration of the neighbouring parts often follows leech-bites; and the effect of a blister in producing serous effusion often extends beyond the skin; and the cartilages of the throat lie very near the surface: and it is possible that œdema of the glottis might be produced, or augmented, in consequence of these topical remedies. It will be better, therefore, when we wish to take blood locally, to take it by cupping from behind the ears or from the back part of the neck: and when we desire to produce counter-irritation, it will be prudent to lay a blister on the upper part of the sternum, rather than to the front of the throat.

Mercury administered with the view of affecting the gums, though sometimes recommended, is not a suitable remedy in this acute disorder. We could neither reckon upon its influencing the system in time; nor upon any marked improvement in the symptoms when it did produce its specific effects.

Hot fomentations applied to the external throat, the inhalation of steam, warm baths, nauseating doses of ipecacuan, or of tartarised antimony, which is in great repute for its power in controlling inflammation of the mucous tissues, are all proper and advisable at the outset of the complaint.

There is a certain caution, however, which I think necessary. I have told you that the epiglottis is apt to become involved in the inflammation. In that case—about which the laryngoscope would always certify you—the nauseating remedies should not be pushed so far as to produce an *emetic* effect. In the swollen, unpliant state of the valve, it would not be prudent to excite or to hazard vomiting. The contents of the stomach passing upwards would be apt to enter the unprotected larynx, and to cause hurtful, distressing, and even perilous attacks of suffocative cough.

In the advanced stage of the disease, *medicine*, I fear, can effect but little.

But *surgery* may be more successful.

The danger arises from the *mechanical* obstacle to the entrance and exit of air into and from the lungs; and this state of peril admits of a *mechanical remedy*. If an artificial opening be made between the obstructed part and the lungs, the air is again freely inhaled and freely expelled; the blood undergoes the vital change from purple to scarlet; and the patient is placed in a condition of safety. He continues to respire through the hole thus drilled in his windpipe until the inflammation of the larynx has subsided; the thickening of the membrane disappeared; the submucous infiltration been re-absorbed; and the vocal instrument been restored to its natural integrity; and then the artificial aperture may be suffered to heal, and the patient will again draw his breath through its natural channels.

This is one of the triumphs of the healing art. It requires a knowledge of the general *pathology* of the disease, i.e. an acquaintance with the facts that acute inflammation may affect the larynx almost exclusively, and that its tendency is to narrow the fissure of the glottis, and destroy life by suffocation. It requires a knowledge of the *symptoms* of such inflammation: and it requires an accurate knowledge of all the essential circumstances of the particular case. For not every case in which the transit of air through the slit in the larynx is hindered, is therefore a fit case for the operation of tracheotomy. Some years ago there was brought to me by a surgeon, a man breathing with considerable labour and constraint, the air passing through the larynx with an audible hissing noise. The surgeon wished to know my opinion of the propriety of opening the patient's windpipe. He had come to the conclusion that there was ulceration of the membrane lining the larynx, with thickening; that the cause of the sibilous respiration was partly mechanical, partly spasmodic; the little muscles that close the glottis acting with injurious energy in consequence of the neighbouring irritation: and he thought that this mischief in the larynx would have a better chance of being repaired, if the functions of the organ could be for a time suspended. He was aware, however, of the necessity of ascertaining what was the condition of the *lungs*; and he had not studied auscultation long enough to trust his own ear in that matter. The patient was pale and thin, and emaciated; and three minutes sufficed to convince me that his lungs were extensively disorganised. His respiration was not so difficult as to threaten suffocation; he was not dying of the laryngeal obstruction; and I recommended that he should not be subjected to an operation which might curtail his existence, but could not effect a cure. The man died soon after: and we examined his body together. There was, as my friend had supposed, ulceration of the membrane near the chordæ vocales, and the lungs were full of suppurating or softening tubercles. I mention this case to show you that it is necessary to ascertain the condition of the thorax generally, before we perform or sanction such an operation as tracheotomy. Not that there is anything very formidable, or painful, or dangerous, in the operation itself. But if we cut a hole in a patient's throat, who is sure to die soon after of some other incurable complaint, we shall incur the risk of being charged with having killed him. Do not misunderstand me, however. If a patient's *life* be threatened by acute laryngitis, or by laryngeal œdema, or by laryngeal spasm, and we are sure of that, and if at the same time we are sure that he carries another mortal disease about him, we are not for that reason to let him die, if we can help it, of the *laryngeal affection*; any more than it would be lawful for us to administer a drachm of prussic acid to a man condemned to be hanged the next morning. But we must state the whole of the case plainly to the patient's friends, and propose the operation as a mode, not of effecting an absolute cure but, of staving off the *immediate* danger.

And here let me repair an omission of which I was guilty when speaking just now of the diagnosis. My object was to guard you against mistaking laryngitis for some other malady; but I must also warn you against the converse error, that of mistaking some other malady for acute laryngitis. I can assure you that such a mistake has been not seldom made; and tracheotomy has been performed, too, when there was no disease in the larynx; and the practitioners by whose authority it *was* performed have been ungenerously reproached for their error, although no harm beyond the slight pain and inconvenience of the operation resulted from it. The cases in which this blunder has been committed have nearly all been cases of *aneurism of the thoracic aorta*, which, by its pressure on the first divisions of the air-passages, or on the nerves thereabouts distributed, had caused that kind of laboured and stridulous breathing which is characteristic of laryngitis.

The true nature of such cases very rarely fails to reveal itself to a skilled ausculting ear. Very rarely—yet sometimes. An instance is recorded by Dr. Johnson in the fifteenth volume of the 'Transactions of the Pathological Society.' The patient's symptoms on his admission into the hospital, were cough with dyspnœa and loud laryngeal stridor, hoarseness and difficulty in swallowing solids. Examination with the laryngoscope proved the absence of laryngitis; and pressure, especially the pressure of an aneurism, was suspected: but there was no physical sign of aneurism, no unnatural dullness on percussion, no pulsation or *bruit*. The pulse was alike at the two wrists. The man died after bringing up, apparently by vomiting, about three-quarters of a pint of florid blood. An aneurism, of the size of a small orange, was found at the back of the transverse portion of the arch of the aorta. It had burst into the œsophagus. The stomach was full of blood. Both the pneumogastric trunk and its recurrent branch had been compressed by the aneurism.

You may recollect my having told you that I had seen a woman whose trachea was laid open by a surgeon while she was suffering under mere hysteria, so closely did *that* disease mimic laryngitis. The laryngoscope will enable you to decide in all doubtful or equivocal cases.

Bear in mind that what I just now called a *blunder*, consists in the practice of tracheotomy in these aneurismal cases, with the view and hope of effecting the patient's *cure*. It may, I repeat, be right, and our absolute duty, to propose and to perform the operation even in cases that are utterly hopeless, with the different view of prolonging life for a while under circumstances of instant danger, and of rendering the act of dying at last more easy.

When you have good evidence that a mechanical obstruction to the passage of the air exists in the larynx, and that the tubes *beyond the larynx* are pervious and free; there are two things which I would urge upon you. First, I would most earnestly advise you *not to wait too long* before you propose or perform tracheotomy; and secondly, never to omit performing it *merely* because it may appear to be then *too late.* If, in the acute and limited disease, an artificial opening be made while the patient's strength is yet entire, and before his whole system is poisoned with venous blood, or his lungs are overwhelmed with sanguine congestion and serous effusion, it will almost surely save his life. But if the sinking of the vital power have got beyond a certain point, tracheotomy will not, in that case, rescue him. It is bad and foolish practice to wait, and try other methods, and postpone the operation as *a last resource*, when the circulation is evidently loaded with unarterialised blood; and the air-tubes and cells are filling up. In my own case I should choose to be operated on early; the moment that I found early bleeding was not *telling* upon the local distress, and that any shade of duskiness became perceptible in the skin: just as I should choose to be operated on at once for strangulated hernia, after one fair attempt had been made by a skilful hand to return the bowel; without waiting till inflammation set in, or had been *caused* by the taxis. On the other hand, if you do not see your patient until his powers are nearly exhausted, do not abstain from the operation even though you may feel convinced that it will be unsuccessful; for if it do not save life, it will disarm death of its agony. A patient will sometimes lie for hours, painfully labouring for breath in deep and strong catches, at considerable intervals from each other: being in fact, just in the condition of a man with a cord round his neck, not pulled quite tight enough to suffocate him at once. Besides, it is not always easy to say whether the period of possible recovery *is* yet gone by. I had a female patient in the hospital who had suffered one or two attacks of frightful dyspnœa, in which the main difficulty was referred to the larynx; but she had rallied from them before any steps could be taken for performing tracheotomy. On the next occasion, however, the seizure was so sudden and rapid, that although Mr. Arnott was luckily in the hospital at the time, the woman was, to all appearance, dead, before he could be found and brought to her bedside. Respiration had entirely ceased. This quietude of the larynx rendered the operation more easy. Mr. Arnott speedily made an opening into the trachea; some air was blown in through the aperture, and then pressed out again; and presently the natural respiration was renewed. The woman recovered; the orifice healed up, and she left the hospital. Three or four months afterwards word was brought that she had died at her own home after a short attack, and when there was no one at hand to open her windpipe. We got permission to examine the body, and found a large ulcer in the trachea, near the larynx; which ulcer by its irritation had occasioned, as we presumed, the spasmodic closure of the glottis. A preparation exhibiting the diseased parts is on the table before you. You see that there was enlargement of the thyreoïd gland. This had probably nothing to do with the symptoms. There was also a large ulcer in the left bronchus.

Mr. Goodeve, surgeon to the Clifton Dispensary, operated on a patient in whom 'no pulse could be found at the wrist; his face was suffused with blood, and his lips livid; and it was hard to say whether he breathed or not:' yet he recovered.

It so happens that there is at present (December, 1838) under Dr. Wilson's care, in the hospital, a woman named Slack, who was rescued when almost *in articulo mortis*, by the same expedient. She had chronic disease of the larynx; but a sudden aggravation of the symptoms occurred; she became stupid and comatose, her countenance was cadaverous, her skin covered with a cold clammy sweat, and her breathing, which had been stridulous and laryngeal, had almost if not quite stopped. She was making short, gasping efforts to respire, not oftener than twice in a minute. Her pulse was intermittent and extremely feeble. In this conjuncture the house-surgeon (Dr. William Merriman) made a small incision in the skin over the cricoid cartilage, and then thrust a large trocar into the windpipe. Air rushed through the opening, the respiration returned, the pulse revived, and the stupor passed away. This happened on October 10. She is still in the ward; the aperture has closed up: and though she is not well, she is *living*.

What is the reason, you may ask, of these different and inconsistent results? How is it that tracheotomy shall reanimate one patient, whose last breath, but for its help, was already drawn, who was already motionless in apparent death; and yet shall fail to save another patient, who is still alive, and sensible of his danger, and struggling with his disease? The difference depends, I make no doubt, upon the time that elapses between the commencement of extreme dyspnœa, and the performance of the operation: upon the slow or the speedy completion of the choking process. And this, again, obviously depends upon the manner and degree in which the passage is narrowed. When the obstruction, though considerable, is incomplete, and does not rapidly augment, the respiration continues to be performed, however imperfectly. What then happens is this. I give the explanation in Dr. Johnson's words, for it involves a theory which was first broached by him and which I believe to be a sound theory: 'The obstruction in the larynx limits the supply of air to the lungs; the blood in the pulmonary capillaries is imperfectly aërated; and some partially aërated blood passes on into the systemic arteries. At the same time the minute pulmonary arteries, by their contraction, lessen the supply of blood to the pulmonary capillaries in proportion to the limited access of air. This contraction of the minute arteries is doubtless called into action by a nervous influence transmitted from the capillaries. A message is telegraphed to the arterial stop-cocks, requiring a diminished supply of blood so long as the respiratory changes are partially suspended. The blood accumulates therefore in the trunk of the pulmonary artery, in the right side of the heart, and in the systemic veins. The distension of the superficial veins renders the lips and the skin more or less livid; while the retrograde engorgement of the bronchial veins and capillaries, which belong to the systemic venous system, results in a serous effusion into the bronchial tubes. This serous exudation gravitates towards the bases of the lungs, filling the air cells and smaller tubes, and thus still further impeding respiration. Meanwhile the slowly-moving partially-stagnating blood in the pulmonary artery becomes more and more viscid, and at length partially coagulates. Hence, on *post-mortem* inspection, fibrinous coagula, which had evidently been in process of formation for several hours before death, are often found in the pulmonary artery.' Secondary causes of apnœa are thus established, which do not cease when the primary cause is at length removed, by the unbarring of the main channel for the admission of air. Whereas when the access of the atmosphere is suddenly or soon shut out, the lungs are not thus mortally injured, but remain capable of resuming their functions when they are again supplied with air.

Tracheotomy, then, will be the most likely to succeed, while the patient is still lively and strong: and after that, the chance of success will be worse in those cases in which the apnœa has been *slow* in its progress, than in those in which it has been *rapid*. I repeat that, in threatening circumstances, the operation should be done *early*; but that it should not be withheld, through despair, at *any* period of the disease.

The effect produced upon the condition of the patient by the timely formation of an artificial glottis, is very striking. The moment that the scalpel penetrates the rings of the trachea, air begins to hiss through the incision; and when a fair opening is established, and a full inspiration is made through the wound, several forcible expirations generally succeed, whereby a considerable quantity of mucus is expelled, which could not pass the contracted aperture of the natural glottis. Then the breathing soon becomes easy, the anxiety and distress are followed by a perfect calm, and usually the exhausted sufferer sinks into a tranquil slumber. This sleep is apt from time to time to be interrupted by the clogging up of the orifice with frothy mucus. It is requisite that some intelligent person should remain by the patient, to assist him in these emergencies, or he may still be throttled, notwithstanding the apparent prosperity of the operation. It is important also that while the patient has to breathe through the opening in the windpipe, the air of the room should be kept warm and moist.

When a sufficient hole has been made in the instrument of the voice, below the glottis, the voice of course becomes extinct, or nearly so; and the patient is as unable to utter a cough, as he is to use vocal language. Now this it is of some importance to notice, for he often wants to cough, in order to clear the air-passages of mucus, or of blood, by which they may be embarrassed; and he may be helped to do so, or taught to help himself. First he should draw in a full breath, and then stop the orifice for a moment with his finger, while he makes the expiratory effort. And as the parts within the larynx recover, the patient, by a similar manœuvre, may enable himself to speak aloud.

As actual examples are more interesting and often more instructive than an abstract of results, I will tell you in a summary manner the history of a case of laryngitis, which occurred in one of my hospital patients, in the latter part of the year 1832. He was an old man, about sixty. His name was Kent. He was brought to the hospital bloated with anasarca, which was most conspicuous in his legs and thighs. His breathing was laborious and difficult, and attended with a wheezing noise, audible at some distance. He could not lie down: he had a hard, but not full pulse. The dropsical swelling had come on suddenly five or six days before; and in the outset his face (he said) was so puffed up that he could scarcely see. According to his own account, he had been bled to the amount of a pint and a half on the previous evening. At that time my opinions respecting venæsection were different from those which I now hold, and have sufficiently unfolded to you. I had a vein opened immediately, and twenty-four ounces of blood were drawn; and eight ounces more were taken from the chest by cupping. He was thoroughly purged with calomel and senna. The bleeding gave him very little relief, so far as the respiration was concerned; but the next morning the anasarca had totally disappeared. I found him sitting up in bed, breathing with much effort, and with a loud stridulous noise which accompanied both inspiration and expiration. He referred all his uneasiness to two points; one of these was the larynx, the other the ensiform cartilage. He swallowed with great pain and difficulty; and every attempt to swallow excited a fit of choking cough. There was no morbid appearance visible in the fauces; every part of the chest sounded well on percussion, and the murmur of healthy respiration could everywhere be heard in his lungs, almost drowned, however, in the louder laryngeal noise. As his strength was entire I had him again cupped to twelve ounces, at the back of the neck; and prescribed three grains of calomel every three hours. He also inhaled the steam of hot water.

Upon visiting him again the same evening, I found the dyspnœa increased. Each act of respiration was attended with a loud wheezing noise. His countenance was beginning to be anxious and ghastly. He was restless; and his pulse was less firm. Being now firmly convinced that the operation of tracheotomy was the only thing that could save him, and that it could not safely be delayed, I sent to request that Sir Charles Bell would come and perform it. By the time he arrived the restlessness had increased. The patient was shifting perpetually from one side of the bed to the other, as if seeking some new point of support; his face had become pale; and his lips were turning livid. He spoke with sudden, and as it were convulsive efforts; stating earnestly how thankful he should be to have the obstacle to his breathing removed; and pointing to the larynx as the seat of his distress.

The ordinary operation, under such circumstances, is by no means an easy one to perform. Its difficulties were well exemplified in this patient. In the first place he was sitting up; he could not bear to be placed in the recumbent position. Then the dyspnœa caused him instinctively to elevate his shoulders, and sternum, and clavicles, to the utmost, so that the trachea was sunk deeply into the thorax; and the larynx was in constant and rapid movement up and down with a plunging motion, like that of the piston of a steam engine. Sir Charles, after some trouble, succeeded in cutting out a piece of the tube: for a mere slit did not suffice: it closed tightly during every inspiration, although it was open enough during expiration. At length, when the air was freely admitted, the breathing became gradually easy. I shall never forget the whole spectacle: there sat the poor man gasping and fighting for breath; his face covered with sweat, and wearing the most anxious expression. By and by what I have called an artificial glottis is opened for him; and presently afterwards, though half a dozen candles (as Sir Charles has himself painted the scene) are held close to his face, to throw light upon the wound, and though the surgeons, their hands smeared with blood, are still busy about his throat, making arrangements to ensure the patency of the orifice, the patient falls fast asleep. It was necessary to place an assistant behind him to prevent his head from nodding forwards, and deranging the apparatus in the wound. Nothing can express more strongly than this fact, the great distress and fatigue which had previously existed, and the perfect relief afforded by the operation.

This man ultimately got quite well; and has since shown himself occasionally at the hospital, in excellent health. There were two or three points about his case which I am unwilling to pass over without notice. It was evident, after the opening was made in his windpipe, that he still breathed in part through the rima glottidis also; for the stridulous sound did not wholly cease. The aperture was formed as low as the circumstances of the case appeared to permit: the tube was perforated in the membranous space between the thyreoïd and the cricoid cartilages. Strictly speaking, *laryngotomy* was the operation performed. I do not enter into the consideration of the best place for making the opening: that point you will be taught by the Professor of surgery: but it was observed in the case in question, that the slightest touch of the irritable mucous membrane, with a hook or a probe—especially if the touching instrument were turned *upwards* towards the glottis—produced a fit of coughing, and a paroxysm of still more laborious breathing. For some days after the operation, it was noticed that a portion of whatever liquid he swallowed *appeared immediately at the wound.* Now this proved as plainly as if we could have seen the parts, that the epiglottis was thickened, and erect, and incapable of performing its protective function to the larynx: and it accounted for the paroxysm of choking cough produced by each act of deglutition. At first the lining membrane of the larynx and trachea was so irritable, that the patient could not bear to have a metallic tube inserted; and an ingenious contrivance was adopted for keeping the orifice from being covered over by the lips of the wound. They were held apart by two bent wires, which were tied together at the back of his neck. After twenty-four hours had elapsed, the irritability of the mucous membrane had so far abated that he was able to breathe through a canula.

There cannot be a doubt that this man was snatched from the very jaws of death by the intervention of the surgeon. A function indispensable to life was nearly suspended; and a substitute for the faulty organ was provided by art, until the interrupting cause was removed. Scarcely a year passes over our heads without the occurrence of one or two such events in the hospital. When lecturing upon this subject last season, I was able to show you a woman whose life had been saved in a similar way. And there is now also (December 11, 1839), in Pepys' ward, a rescued man, with the tube still in his windpipe. The operation was done on the spur of necessity by Mr. Tomes, the present house-surgeon, with a trocar. The patient, who was previously in a state of extreme distress, said, in a faint whisper, as soon as the opening was effected, 'It's all right now.'

He had been exposed to rain and cold about a week before; and had suffered pain and tenderness of the larynx. Prior to his admission he had been bled, *and salivated,* and had a *blister on the throat, which embarrassed the operation.*

Within eight successive years the operation of tracheotomy was performed in the Middlesex Hospital fourteen times. Seven of the patients recovered; seven died. In two of the seven fatal cases, the condition of the patients was hopeless at the time of the operation. In four at least of the five others much relief from suffering was afforded by it, and life apparently prolonged. One of the patients was a young child: the opening was made by a trocar; much blood got into the air-passages, and the child, which seemed to be sinking previously, died within the hour. Life might, I think, have been preserved in this case, by a *timely* operation, properly done. For a trachea so small, the scalpel is preferable to the trocar. But in the adult subject I have seen the larynx penetrated so neatly, easily, and speedily, both by Mr. Arnott and by Mr. Shaw, with a small curved trocar, that I infer the general superiority of that method over the common operation with the knife or scissors. If this be granted, the fit place for the opening must be the membranous space between the cartilages. The superjacent skin is first nicked with a scalpel: the larynx is then fixed for a moment by the operator's left hand, while with his right he thrusts the instrument steadily inwards and downwards.

The main exciting *cause* of laryngitis is exposure to cold, or to cold and wet. My hospital patient, Kent, was a seller of small wares in the streets, and must therefore have been habitually in the way of such causes. The first attack of the disease in Sir J. M. Hayes was brought on by exposure at an open window to the night air for some time, while he was undressed, and in a state of profuse perspiration, with a strong breeze blowing upon him. Dr. Craigie states that young persons from tropical climates, from the West Indies for example, are very apt to be attacked by laryngitis soon after their arrival in Europe.

The disease is liable to be produced also by mechanical violence, or chemical injury done to the larynx. It has been caused, on many occasions, in children, by their attempting to swallow boiling water from the spout of a tea-kettle; and life has been saved in such cases by the performance of tracheotomy. The mineral acids, taken as poisons, have excited the disease. Fatal laryngitis has followed the incautious application of ammonia to the nostrils, in cases of hysteria, and of suspended animation: and I once knew a man nearly killed by the inhalation of the fumes evolved from cinnabar thrown upon a hot iron, in what is called *fumigation* of the throat for venereal ulceration of that part. I am afraid that I must confess also to have once seen acute laryngitis produced by the bungling attempt of a young surgeon to introduce the stomach pump, in a case of poisoning.

In all these cases the laryngitis is primitive. But laryngeal inflammation, and especially laryngeal *œdema*, not unfrequently takes place, and proves suddenly fatal, in the course of other diseases. I have apprised you that in cynanche tonsillaris, the inflammation sometimes steals onward to the larynx. I have seen some cases of erysipelas of the head, attended, as it almost always is, with sore throat, wherein death took place suddenly and unexpectedly, and where the epiglottis, and the edges of the fissure of the glottis, were found to be œdematous: the inflammation of the throat had extended to the areolar tissue beneath the mucous membrane of those parts, and had led to the effusion of serous fluid there. The very same thing is apt to happen in other forms of exanthematous disease attended with sore throat, and especially in smallpox, measles, and scarlet fever. I have known a similar condition of inflammatory œdema arise from a *mercurial* sore throat, in a broken-down constitution. In these cases the laryngeal affection is consecutive, and secondary; and in all of them the great remedy is the formation of a sufficient aperture beneath the obstructed glottis. In all of them also the essential symptoms, warranting and demanding the operation of tracheotomy, are the same.

Since the foregoing remarks were delivered and published, this subject has been brought before the profession by Dr. Budd, in a paper read at one of the meetings of the Medical and Chirurgical Society, in 1847. He relates several cases, and refers to others, which justify the belief that acute œdematous inflammation of the larynx, is connected more frequently than had hitherto been supposed with erysipelas. That disorder, as I shall hereafter show you, is apt to be propagated from person to person by infection; and the effects of the poison, which thus excites the disease by contaminating the blood, are sometimes displayed first of all in the fauces and their vicinity. Now these effects, redness and thickening of the epiglottis, and of the lips of the glottis, with the effusion of sero-purulent fluid in the submucous areolar tissue—sometimes prove fatal, producing death by apnœa, before the erysipelatous inflammation has time to spread far, or to declare its true character by developing itself upon any part of the external skin.

A distinction has been made between *laryngitis* and *œdema of the glottis*; and it is a just and real distinction. Œdema of the loose areolar tissue subjacent to the mucous membrane of the glottis is indeed one common consequence of inflammation of that membrane: but it may occur independently of inflammation. The lips of the glottis become tumid and *dropsical*, sometimes (as I have just pointed out) in consequence of a low inflammatory action in the throat, but sometimes also from obstruction of the veins leading from that part.

The main practical difference between mere œdema glottidis and acute laryngitis, is this: that in the former, there being no fever or inflammation, no blood-letting can be requisite, and the operation of tracheotomy becomes almost the sole resource to which, in the extremity of danger, we can look for help. Mere œdema glottidis is seldomer attended with dysphagia too, than is laryngitis; yet if the epiglottis be involved in the œdematous swelling, and unable to shut over the glottis, the act of swallowing will be followed by strangling cough, and increased dyspnœa.

Mr. Busk has recommended a peculiar mode of treatment in these cases, whereby he believes the lives of two patients to have been saved in the Seaman's Hospital on board the Dreadnought. The treatment consisted in making numerous minute punctures, with a sharp-pointed bistoury, in the back of the tongue, in the uvula, and in the pharynx. The operation was repeated every half-hour for two or three hours, and the parts were gargled in the interim with warm water. A great discharge of serum took place, and the relief was sudden and decided. Mr. Busk is of opinion that this proceeding would often preclude the necessity of laryngotomy.

The laryngitis of which I have as yet been speaking is acute inflammation of the larynx, *occurring in adults.* But children, and infants even, are equally and indeed more liable to laryngitis, and in them it is a still more perilous disease; partly because spasm is very readily superadded in these young and susceptible creatures, but chiefly because the small calibre of the primary air-passages at that early age renders the great mechanical remedy, tracheotomy, more difficult to perform, and its success less to be relied on, than when it is timely resorted to in older persons.

I must here ask you to take accurate notice of a most material rectification of our views that has been recently made in this country, in regard to infantile laryngitis. In all our medical literature for the last hundred years, it has been called *the croup.* Now this term croup, used absolutely, is very misleading, for it has been applied to at least three different disorders: to *infantile laryngitis*, the disease now before us; to the much more dangerous disease called *laryngeal diphtheria*;

and to the much less dangerous disorder, named *laryngismus stridulus.* By Trousseau and other continental writers, the term croup is limited to diphtheria affecting the larynx and trachea.

To obviate confusion, and erroneous inferences from medical records, and serious mistakes in practice, it is desirable that this familiar but ambiguous word should either go out of use—which it is not likely to do—or should always, in speech or in writing, have prefixed to it a distinctive epithet. Thus we might have :—

Spasmodic croup; the laryngismus stridulus of English authors, child-crowing, a nervous affection with no structural disease whatever of the larynx:

Inflammatory croup; simple infantile laryngitis, a strictly local and catarrhal inflammation, not at all contagious : and

Diphtheritic croup ; membranous laryngitis, a specific, general, and contagious disorder.

Adopting these distinctions, and keeping them steadily in view, I may tell you that the symptoms of simple laryngitis do not differ greatly in kind whether it happen in a child or in a grown-up person. But in conformity with custom I shall speak separately of the disease as it presents itself in early life.

Infantile laryngitis, wherefore I know not, occurs more frequently in boys than in girls. The interval that lies between the two periods of *weaning* and *puberty* is the time during which its visitation is chiefly to be apprehended.

Comparatively few cases of it occur during the first year of infantile life. There are more in the second year than in any other. This, in all probability, is connected with the change that ensues in regard to diet, upon the child's being weaned. Dr. Cheyne, whose experience on the subject was very extensive, says, that the younger children are when weaned, the more liable are they, *cæteris paribus,* to this malady.

The laryngeal inflammation is frequently preceded by a slighter and more diffused affection of the membrane lining the air-passages. The child has what is popularly called a cold ; sneezes, coughs, and is *hoarse.* Now with respect to this last symptom, Dr. Cheyne makes the following practical remark. Hoarseness (he says) in very young children does not usually attend common catarrh. Its occurrence therefore ought to put the parents or the medical attendant of the child upon their guard ; especially as much depends upon the early treatment of the disorder. With these symptoms the child is feverish and fretful, and does not sleep well. In the course of a day or two the signs peculiar to laryngitis begin to show themselves: they are well stated by Cullen, in his definition of the complaint. 'Cynanche, respiratione difficili, inspiratione strepente, voce raucâ, tussi clangosâ, tumore fere nullo in faucibus apparente, deglutitione parum difficili, cum febre synochâ.' These are the phenomena that characterise the disease. Difficulty of breathing; and sonorous inspiration. The last is often almost enough, of itself, to identify the disease. Hoarseness; a gruff voice; sometimes a total loss of the power of vocal speech. A very peculiar and distinctive cough, to which the epithet 'brassy' has been justly applied; the noise resembling that which would be occasioned by coughing through a brazen trumpet. This remarkable sound is always easily recognised when it has once been heard. It is a *ringing* cough; and the expiration has a ringing character; and either of these, the cough or the expiration, is followed by a loud *crowing* inspiration: and with all this, inflammatory fever; a flushed face, a hot skin, a frequent hard pulse, thirst.

However, it is by taking the symptoms collectively, that we judge of the existence of infantile laryngitis, and by the rapid progress of the malady, rather than by any particular or pathognomonic sign. Some of the symptoms may occur, separately, when there is no such disease. The brassy or metallic cough, for instance, has been known to accompany some chronic affections of the larynx. Dr. Gregory—the late Edinburgh Professor of Physic—knew a man with a venereal disease of the throat, who coughed so exactly the cough of laryngitis, that he was admitted into the clinical wards of the infirmary every session for some years, that the students might have the opportunity of *hearing* this peculiar sound. So also the remarkable crowing inspiration may take place, as I have said, and as we shall soon more fully see, without laryngitis.

In the outset, the fever generally runs high; and it is of importance, as respects the diagnosis, to mark the presence or the absence of pyrexia. As the obstruction to the passage of air increases, the blood ceases to be duly arterialised: and then, of course, the skin grows dusky, the pulse feeble and irregular, the extremities cold. The cough, also, as the malady thus goes on from bad to worse, ceases to be loud and clanging, becomes husky, and inaudible at a short distance, and the voice sinks into a whisper; the head is thrown back; the nostrils, in perpetual motion, dilate widely; the face is pale and livid, and sometimes bloated; the pupils often expand. When these indications of sinking have come on, the case usually terminates ill: the bottoms of the feet turn black and hard; drowsiness supervenes; some tossing of the arms perhaps; the breathing becomes gasping and interrupted, and the child dies after an *in*spiration.

In other cases the laryngeal symptoms make their attack very suddenly. A child shall go to bed apparently well, and in the course of the night have all the worst signs of the disease. And it is observable, that whether the attack be altogether unexpected, or whether it have been preceded by hoarseness, sore throat, and catarrh, it usually comes on *in the night.*

As in the adult so in the child, the complaint runs its course rapidly: proving fatal sometimes within twenty-four, and often within forty-eight hours. It may, however, continue for five or six days before it terminates, whether death or recovery be the result. Dr. Craigie affirms that it is never protracted beyond the *eleventh* day; the fatal or the favourable issue having always taken place by that time.

The difficulty of breathing, and the characteristic sounds that accompany it, depend, in part, no doubt, upon spasmodic contractions of the small muscles of the larynx: for remarkable aggravations of the dyspnœa are apt to occur, and to subside again; and these aggravations are sometimes brought on by sudden causes—by the movements of deglutition, for example.

It is easy, you know, at any time, by an effort of the will, to close the glottis, and to prevent the passage of air to and from the lungs. This is mainly effected by the action of the little muscles that bring together the arytenoid cartilages. But those muscles, like the other muscles concerned in respiration, act also independently of the will, spasmodically therefore, through the reflex function of the spinal cord. And it is by a providential and conservative appointment that they do so act, as janitors, admitting, in the healthy state, the vivifying air, but barring the door against certain hurtful gases, and against solids and liquids which would be injurious to the respiratory apparatus. We know that if a drop of water, or a crumb of bread, or a whiff of carbonic acid gas, gets past the outer defence, the epiglottis, and into the larynx, spasmodic action of the little muscles in question is instantly excited. We cannot see these intruders, and voluntarily resist their entrance, but the unsleeping sentinel is there to guard the passage. We may well conceive, therefore (and I know not how the supposition can be disproved), that the noisy and difficult respiration of laryngitis may be caused, in part, by spasm.

The disease is not contagious; although, like cynanche tonsillaris, and for the same reasons, it is found sometimes existing at the same time, or in quick succession, in more than one child of the same family. Thus two twin children of Dr. Gregory's were seized with 'croup' on the same night. They had both been walking in the evening on the sea-shore during a cold wind. This is in accordance with what Dr. Cheyne has stated, that the attack is almost always nocturnal, and often when the child has during the preceding day been exposed to the weather. It frequently occurs sporadically; but there are places in which the disease appears to be endemic. Dr. Cheyne found it so on the coast of the Frith of Forth. Indeed, the first distinct account of it that we possess was drawn up by Dr. Home, of Edinburgh, in 1765, from much personal observation of its ravages in Leith and Musselburgh. Cold situations—and damp places, more than such as are merely cold,—are subject to the prevalence of this disease. It is accordingly frequent in the seasons of winter and spring. It is said to be most common near the sea-shore, and in the neighbourhood of large bodies of water generally. It occurs in low, moist, what are called in Scotland *carse* districts, oftener than in upland situations that are more exposed to cold winds. It is more common at Leith than it is in Edinburgh; and in Edinburgh it is most frequent in the lowest parts of the town. This I learned from Dr. Alison, who, having long been physician to a dispensary there, had had ample means of observing the disease. Canal Street and the Cowgate, both low spots, as some of you may know, have long been famous, or rather infamous, for cases of croup. Towns situated on the banks of rivers have more than the average share of it; and it has been observed to be particularly frequent among the children of washerwomen in such places; and thus evidently connected with exposure to moisture. In towns so situated, it has been known to prevail epidemically after an inundation. And Dr. Alison has made a very curious remark respecting it. He says that it seems to be often produced by the child's sitting, or sleeping, in a room newly washed: and that he has noticed its frequent occurrence on a Saturday night—the only day in the week on which it is customary for the lower orders in Edinburgh to wash their houses.

Like cynanche tonsillaris, and unlike cynanche parotidœa, this disease is exceedingly apt to recur. Relapses may happen within a few days after apparent recovery; and these are very perilous. But besides this tendency to a renewal of the severer symptoms, the little patients are often affected with cough, and hoarseness, and even with aphonia, for a long time. And while these relics of the acute attack continue, it is easily brought back again. The first seizure is generally, I believe, the worst: but to this rule there are numerous exceptions.

Infantile laryngitis is a disorder which always excites extreme alarm in the friends and parents of the patient: but the prognosis, when early treatment is adopted, is not very unfavourable. You will by-and-by perceive why we cannot rely upon some recorded statistical evidence supposed to have a bearing on this point.

The prognosis is chiefly to be collected from the general condition of the child. In these little patients, and amid the laryngeal noises, it is difficult to ascertain the physical state of the lungs. If the distress of breathing seem to remit, and free expectoration to come on, while the strength is yet entire, we venture to hope. On the other hand, we begin to despair when the lips are becoming blue, the skin is losing its heat, the pulse is already feeble and intermitting, and the little patient is drowsy or comatose: in other words, when we perceive the final symptoms of death in the way of apnœa. Some few patients die suddenly and unexpectedly without any previous coma.

The mortality will differ according as the disease is detected early, and treated vigorously,—or otherwise. And with respect to treatment, there is no specific remedy for this, any more than for any other inflammation. We must put in force the general principles upon which the treatment of inflammation is founded; adapting them, however, to the malady in question by those particular rules which the experience of the best observers has collected for our guidance.

I need scarcely repeat, that when cough and catarrh, and especially hoarseness or loss of voice, are noticed in a young child, he should be narrowly watched, and protected against all circumstances likely to excite or to aggravate inflammation: he should be kept in the house, and put upon farinaceous diet; and the functions of the bowels and of the skin should be attended to.

The remedies for infantile laryngitis are the same as those which I recommended you to employ when the same disease befalls an adult person: nauseating doses of ipecacuan or of antimony, warm baths, the application to the throat externally of a large sponge from which hot water has just been squeezed out, the inhalation of the vapour of hot water. We desire to *sweat* both the skin, and the affected mucous membrane. These means failing, we resort to tracheotomy.

Blisters are sometimes applied, but with very questionable propriety. In the outset they are likely to do harm; in the advanced periods of the disease they are not likely to do good. If used at all they should be placed, not on the throat, but across the upper part of the sternum.

That the mechanical expedient of tracheotomy should be successful, it must, as in the case of an adult patient, be performed in time; and in both cases the same symptoms bespeak the demand for its performance. For reasons that I have already given, it is less trustworthy in these small persons than in those who are full grown. In the latter, the *larynx* may be penetrated. A child's larynx does not afford room enough for the introduction of a canula. The opening must be made in the upper part of the *trachea*, as near as may be to the larynx. Though difficult, and too often ineffectual to save life, it is not, even for that purpose, a hopeless operation. Sir William Fergusson (Dr. Johnson tells us) operated with complete success upon an infant about two years old. Trousseau was equally fortunate with one infant of thirteen months, and with another two years old all but six days. After the third year, more hope may be encouraged. Tracheotomy, I say once more, is the most likely to succeed in cases of recent origin and rapid progress. When there has been 'urgent dyspnœa of long duration, there will always be reason to apprehend pulmonary congestion and effusion, and stagnation of the blood in the pulmonary artery.' The symptoms that imperatively cry out for the operation are increasing pallor, cold sweats, lividity of the skin and lips, extreme feebleness of the pulse, and a sinking in, during every effort to inspire, of the intercostal spaces, of the hollows above the collar bones and the breast bone, and of the flexible lower margins of the thorax. I must, however, return to the subject of tracheotomy after I have dealt with another of these throat affections.

As the differential pathology of the various affections of the larynx has been matter of discussion in this country among skilled and practical men, I shall next proceed to speak of *Diphtheritic Laryngitis*, or rather of *Diphtheria* generally; in order that we may have before us the facts respecting the true construction of which there has been, and there may perhaps still continue to be, some doubt or controversy.

I had been for more than a quarter of a century in practice in London before I ever met with a case of Diphtheria; or scarcely so much as heard of such a disorder. In the year 1855 alarming rumours reached this country of its prevalence and fatality at Boulogne. Soon afterwards scattered cases of the disease began to appear among us, and presently so multiplied in number as to constitute a real epidemic. It has never since ceased to be the dread of parents, and I may truly say of medical men also.

Do not conclude, from what I have just said, that Diphtheria is a new disease, the offspring or discovery of this generation. It had long—it has always—been known, though not by the same name. Accounts of its ravages in by-gone epidemics may be traced back in our own medical records; and mention of it runs up into remote antiquity. In modern times, Starr has described an outbreak of the disease, about one hundred and twenty years ago, in Cornwall. In its epidemic form, it has been much more prevalent in France than in Great Britain. Bretonneau watched and has recorded a visitation which desolated Tours in 1818 and the three following years. He it was who, from one of the most constant and striking phenomena of the disease, first gave it its now familiar name. Trousseau has also written fully and well upon the subject, drawing his materials from his own large official experience. Sir William Jenner has published two most interesting and instructive lectures, embodying the results of his actual observation of the disorder at the Children's Hospital and elsewhere, with his views as to its nature. And there are some valuable notices of it by the late Dr. Hillier to be found in the volume of the 'Medical Times and Gazette' for 1862. It is to me a comfort that my own personal acquaintance with the malady has been comparatively so slender.

Although the complaint includes diphtheritic laryngitis, it has a wider scope; and is more especially and more often, in the outset at least, a *pharyngeal* affection in its local as distinguished from its general manifestation. The proper place for diphtheria in any methodical nosology would be among the specific fevers; but I take it up here for the sake of comparing it with other diseases which it more or less resembles, and of stating and considering the conflicting views that have been held concerning it.

Its local, or what are sometimes called its anatomical characters, are of this kind. It has the primary form of sore throat. If you look into the fauces of a patient who has this disorder upon him, you will usually see that the tonsils, uvula, velum palati, and pharynx are of a dusky red colour, and that in one or more places they present a white or gray-coloured patch of exudation from the affected surface: an albuminous exudation, which soon stiffens into a membranous form, and which may vary in consistence from that of cream or paste to that of a thin kid glove. It was this skin, *διφθερα*, so declaratory of the nature of the complaint, that furnished to M. Bretonneau his name for the disease.

Now this diphtheritic inflammation, and its membraniform result, is prone to spread—and to spread in different directions; backwards and upwards sometimes into the posterior nares; more frequently passing over the epiglottis and into the larynx and trachea, and even diving into the smaller air-passages; and now and then, but very rarely I believe, it creeps along the œsophagus, and down to the stomach. Of this last unusual extension Sir William Jenner has seen two instances.

You will at once infer the gravity of this disorder when you think upon the parts and the functions which the false membrane is likely to obstruct. But it has other sources of peril.

Together with this local damage, which may soon destroy life mechanically, there are the symptoms that mark the general disease, and may end fatally at a somewhat later period, even though the local mischief may have been removed or recovered from. They comprise a certain amount of fever, a peculiar tint of the skin, bleedings from the nose, great debility, a rapid and feeble pulse, or, which is still worse, a morbidly slow pulse.

And even after convalescence from these symptoms, local and constitutional, may seem to have begun, there are apt to arise grave and remarkable sequelæ, still compromising the patient's safety: symptoms of disordered innervation as we speak, paralyses of certain parts, of the velum palati especially, and often shifting from one part to another; tingling, numbness, and debility of the limbs, impaired vision.

Such in broad outline is a sketch of this formidable malady. I will fill in some of its features a little more minutely.

At first the white well-defined exudation is easily detached; and the subjacent mucous membrane, except that its epithelium is gone, is apparently healthy: but by degrees, as the exudation grows thicker and more tough, it dips deeper also. It may be torn off in strips, but the surface beneath is then often seen to be raw and bleeding, and it soon becomes covered with a fresh layer of exudation. The deeper lying tissues harden, and contract a little. The lymphatic glands at the angle of the jaw become swollen and tender. Trousseau lays great stress on this as a distinctive sign; but Sir William Jenner justly observes that it is not a feature peculiar to diphtheritic inflammation. It is a general fact that when any part is deeply inflamed, and especially when the inflammation has a specific character, the lymphatic glands to which the lymphatics of the inflamed parts lead become the seat of active congestion, and ultimately of inflammatory exudation. The formation of the false membrane takes place more rapidly in children than in adults.

Occasionally, but not as a rule, the patient's breath becomes very offensive, and you might suppose that there was gangrene and sloughing of the throat. It is not so. The occasional fœtor arises from decomposition of the membranous mass, or of portions of food or drink which get entangled in it; and the fœtor may be got rid of by cleansing the throat with some deodorising wash. This is a point not to be overlooked: for I shall hereafter have to describe to you a very terrible form of gangrenous throat, which is apt to accompany some of the worst conditions of scarlet fever. In the diphtheritic throat there is scarcely ever any real mortification or sphacelus.

With some few exceptions, in which a peculiar state of the throat and uvula makes deglutition exceedingly painful, there is seldom in the outset any great difficulty of swallowing; nor is pain of the throat of frequent occurrence. Hence the complaint is apt to be insidious in its approach. The patches of false membrane may come, and go, without our knowledge, if we are not careful, and on the alert upon the slightest hint, in looking into the fauces. In the case of a young child this inspection will be difficult and abortive, or easy and instructive, according to your method of procedure in making it. Both Trousseau and Sir William Jenner give the requisite rules; which are too often neglected, or unknown. In the first place the child's head and limbs must be firmly held, and fixed immovably, by an assistant. Then a broad and *strong* unbending spatula, the handle of a *table*-spoon if nothing better can be had, must be passed *far back* into the child's mouth as soon as it opens it to cry: as far back as the root of the tongue, which is to be forcibly depressed and pulled forwards. The fauces will thus, if the light be properly managed, come clearly into view, and the suitable applications may be made to the seat of the disease. I should recommend you to make use on these occasions of the reflecting mirror, placed upon your forehead, as directed in Dr. Johnson's little book. This will enable you with great ease and certainty to throw the light upon any part within the mouth; and, what is of great importance, you will have both hands at liberty—the one wherewith to depress the patient's tongue, the other to apply your remedies.

Cough is one of the symptoms of the disease, at first short, dry, and coming on in fits. Then, as the disease invades the larynx, both cough and voice grow hoarse, husky, muffled, extinct; and the breathing stridulous. Paroxysms of severe dyspnœa occur, from superadded spasm no doubt; the lips and face become pale or livid, and death by suffocation closes the scene.

Strips of the false membrane are sometimes detached and brought up by the cough, with temporary, or possibly with permanent relief; but the membrane is too apt to be renewed, and it may be renewed with great rapidity. I show you here a preparation belonging to the Museum of the Middlesex Hospital. Upon a child on the very brink of suffocation the operation of tracheotomy was performed, at one o'clock in the morning, by Mr. Chevalier. A tubular portion of membrane, of the size and shape of the trachea, was presently forced through the artificial opening. Immediately the child's respiration became easy, and it fell asleep. In the course of the same morning Dr. Sweatman was hastily summoned, and arriving at eight o'clock, found the child dead. It had slept six hours and upwards; and then the distress in the breathing had returned, and was soon fatal. The trachea was found to contain a new tube of lymph or of concrete albumen. The preparation proves that such a membrane may re-form within that short space of time; viz., in from six to seven hours.

It is important to know, and to bear in mind, that the disease sometimes strikes its first blow (to use Trousseau's expression) at the larynx, and then ascends to the pharynx; or it may attack all these neighbouring parts at once: but nineteen times out of twenty, according to Bretonneau, the pharynx is its starting-point.

Diphtheria is a very fatal disease. It may destroy life in the way of apnœa, mechanically, by suffocation; or in the way of asthenia, which may either be due to the weakening influence of the general disease, or, more rarely, to a failure in the functions of particular nerves. I will give you the upshot of Sir William Jenner's experience upon some of these points, which accords very closely with that of Bretonneau.

The duration of the cases which he had then seen (about 58) varied from forty-eight hours to fourteen days. When death took place within a week from the first symptoms of illness, it was always preceded by extension of the exudative inflammation to the larynx. He had never known laryngeal symptoms *begin* after the expiration of the first week of the disease. They were now and then the first symptoms to attract the attention of the patient or the patient's friends. Twice he had seen death occur within twelve hours from the time when the laryngeal symptoms were first noticed, and he had never known death delayed more than five days from the time when symptoms indicated clearly that exudation had occurred in the larynx. In rather more than half of the fatal cases that he had seen, death was the direct result of the laryngeal affection; and in rather more than half of the remainder, laryngeal disease was present, although death apparently took place from asthenia. When death had occurred from asthenia—the consequence of the general disease—the fatal issue had usually happened during the second week of the disorder, unless the patient had been greatly weakened by some previous illness.

In the non-fatal cases the specific disease terminated between the eighth and the fourteenth day.

Like all the other disorders belonging to the same class, diphtheria spreads by contagion. Of this the proofs are abundant and conclusive. I must, however, postpone to a later period of the course all consideration of the nature and degree of the evidence requisite to establish the contagiousness of any disease. I will give you, however, one example of its *kind*, taken from Mr. Simon's second report to the Privy Council.

'No case (says Mr. Eastes) of diphtheria had ever been seen in Folkestone during my time, until Isabella W., aged four and three-quarter years, arrived from Boulogne on the evening of July 2, 1856, being then in an advanced stage of the disease. She died on the following day. On July 6, Catherine W., her sister, aged ten, was attacked, but she had never been in France; she had always resided on the East Cliff, Folkestone, in the same house to which her dying sister was brought four days previously. One other case occurred in the same house three days after, and all terminated fatally.'

Can this disease be communicated by inoculation? There are facts which tell for, and there are facts which tell against, the affirmative answer to this question. M. Valleix, a well-known and esteemed French surgeon and writer, was in attendance upon a little girl suffering from diphtheritic sore throat. The child recovered. One day, while M. Valleix was inspecting her throat, he received into his mouth a small quantity of saliva driven out of that of the patient in the act of coughing. Next day a small pellicle of exudation appeared on one of his tonsils. The other tonsil and the uvula became speedily covered with false membrane, a profuse discharge took place from the nostrils, the cervical glands and the areolar tissue around them were swollen, delirium supervened, and in forty-eight hours, without any laryngeal symptoms, M. Valleix was dead. Another medical friend of M. Trousseau's was performing tracheotomy for diphtheritic laryngitis; some blood got into the patient's trachea, and was sucked out by the mouth of the operator, who also died in forty-eight hours with symptoms precisely resembling those of M. Valleix.

These dreadful cases look very like cases of inoculation. They seem to show that direct contact of the poisonous matter may produce the disease, manifesting itself at once without any lengthened incubation, and even proving rapidly fatal.

Strange to tell, M. Trousseau himself had the courage—shall I call it the fool-hardiness?—to put the question of inoculation to the test, on his own body. He punctured his left arm, his tonsils, and his velum palati, with a lancet moistened by contact with a false membrane which he had just removed from a diphtheritic sore. A friend of his, Dr. Peter, once by accident, and twice by his own design, became the subject of similar trials. No harm ensued in either case. Trousseau concludes, therefore, that diphtheria is not more inoculable than scarlet fever, measles, or hooping cough—maladies which are undeniably contagious.

In weighing these facts, we must admit either that M. Valleix and the other surgeon mentioned had already contracted diphtheria by inspiring the infected atmosphere about the patients, or their very breath: or else that the disease was engrafted upon the faucial mucous membrane by the matters coughed upon it in the one case, and introduced by suction in the other. If the latter conclusion be the right one, we must suppose that some persons are naturally much more susceptible than others of the influence of the specific contagion. This view receives support from the observation of Sir William Jenner that the disorder is prone to occur in certain families—and is tantamount to an inferential belief that a tendency to a ready reception of the disorder may be an inherited constitutional tendency. This feature is in fact common to the whole class. Sir William Jenner is even inclined to believe that, of the two conditions for developing the disease—complete exposure to the contagious principle, and predisposition on the part of those receiving it—the latter is by far the most important.

Like the rest of the class, diphtheria is undoubtedly a blood disease. Indeed, Dr. Millard found, upon examining blood drawn from a diphtheritic patient, that it was *visibly* altered: instead of being of the usual red colour, it was brown, like plum juice, and stained his fingers.

One important circumstance (first pointed out by Dr. Wade, of Birmingham, and also indicative of contamination of the blood), is that the urine in diphtheria, in many or most instances, contains more or less of albumen; and this without any of those peculiar conditions of the kidney which bespeak the presence of chronic Bright's disease; and without any concomitant dropsy.

The paralytic symptoms that are so often noticed as sequelæ of the throat affection when that has been recovered from, are extremely curious and interesting. The most common of these is paralysis of the velum palati, causing a snuffling nasal tone in the voice, and some impairment of the power of deglutition. The velum is seen to hang motionless in the fauces, and to be insensible to ordinary stimuli. Besides this, the patients are liable to obstinate vomitings, to dimness of sight, to numbness, tingling, and diminished power in the hands and feet. And it is remarkable that these paralytic symptoms are often fugitive and shifting, affecting now one part and now another. Mostly they are, at length, recovered from. There is, however, one way, well worthy of your notice, in which they may become the cause of death. Sir William Jenner draws attention to the fact that the most common and the most prominent of these paralytic and other sequelæ—paralysis of the velum, difficulty in swallowing, the return of drinks through the nose, choking sensations, obstinate vomiting—relate to parts supplied with nerves from the par vagum: and he refers to the experiments of Weber, which show that irritation of the pneumogastric nerves retards the movements of the heart; that these nerves are inhibitory, as physiologists speak, of its action. If an interrupted current of electricity is sent through one or both of these nerves, the heart comes to a dead stop, and remains for a while in the state of diastole or relaxation. Its action is soon resumed, however, when the electric shocks are discontinued. Now, in the sequel to diphtheria, instances have been observed of death which appeared to result from mere retardation and ultimate stoppage of the action of the heart. Sir William Jenner records two such cases, which he saw in consultation; one was that of a boy ten years old, a patient of Mr. Adams'. He had had diphtheria mildly. The exudation on the pharynx had been slight; swallowing was easy; the general symptoms, except that the pulse was feeble, were trifling; on one day only a trace of albumen was found in his urine. The boy was deemed by his parents convalescent, when vomiting set in, and the weak beats of the heart began to diminish in frequency. There were no other grave symptoms except the vomiting. Notwithstanding the free use of stimulants, the pulse fell to 32, and presently to 24 beats in the minute, and the patient died, apparently from the cessation of the heart's action. In another case, a little girl, a patient of Mr. Jay's, died a fortnight after the first symptoms of diphtheria. Mr. Jay noted stertorous breathing, diminution of temperature with free perspiration, return of fluids through the nose, with so great a fall in the frequency of the pulse that, for some time before death, there were not more than 16 beats of the heart in the minute.

Much more commonly, however, the pulse becomes extremely frequent.

All these sequelæ are significant of blood-poisoning. We cannot suppose that the nervous symptoms—transient and wandering as they often are—can have their cause in any grave or material damage in the nervous centres. They denote, I presume, disturbed nutrition of the tissues from imperfect or altered conditions of the circulating blood.

The nervous sequelæ were very marked and severe in the person of our valued Professor of Midwifery in this College, Dr. Priestley. He fell ill on March 11, 1863, of diphtheria contracted from some patients whom he was attending during a depressed state of his own health from overmuch work. The specific exudation did not, I believe, at any time transgress the limits of the fauces and soft palate. At the end of a fortnight, being apparently convalescent, he went down to Brighton.

There, nearly a month after the first invasion of the diphtheritic attack, the nervous sequelæ began to develop themselves. You will be glad to hear the very words of the written description of them, with which Dr. Priestley has been kind enough to favour me. Such a narrative is peculiarly valuable and interesting, as conveying the trustworthy results of close and critical observation by a skilled physician upon what happened in his own person. 'I had not been many days at the seaside,' he writes, 'when I began to experience an overwhelming sense of general weakness. My pulse began to intermit; and on my getting upright, particularly in the morning before breakfast, the heart's action flagged, and I was obliged to lie down, pale and faint, with my toilet uncompleted. A little later, and I found it impossible to read. In a few minutes after taking up a book or paper, the print gradually grew smaller, and receded from my vision. This was to me a great trial, as hitherto I had managed to amuse myself, and break the tediousness of recovery. In another day or two it was noticed that I squinted, and in a few more days my voice became altered, and I could not manage it so as to complete a sentence. With this came difficulty of swallowing of a totally different character from that experienced at the outset of the diphtheria. The muscles of the soft palate acted in so imperfect a manner that in swallowing fluids a portion was pretty sure to pass upwards and return through the nostrils. In another week I found my fingers less dextrous, and the holding of a knife, fork, or spoon was not so easy as formerly. I managed these articles well enough at first, so long as my eye was fixed upon them; but if my attention was diverted away, they dropped at once. Hereafter the paralysis gradually extended downwards. Soon I began to totter in walking, and although I was able to go on for a while with the assistance of a stick, or the arm of a friend, eventually these aids ceased to be of use, and I was reduced to such utter helplessness that my hands could neither seize nor retain any object put into them; and the lower extremities were so powerless that I should have fallen at once to the ground if I had attempted to stand. Indeed, if I lay down flat on my back I could not rise without help; and I frequently fell into some uncomfortable position on a bed or sofa, and was obliged to remain there till extricated. My intellect was quite clear through all this, and I was able to observe that, while sensibility of the skin remained intact—perhaps was in some degree exaggerated—I lost entirely what is called *muscular* *sense.* I felt as if my legs were clogged by some heavy weight, and when I was supported between two men, my feet dragged along the floor as though they did not belong to me; the noise of my trailing boots only attracting my attention. Before the loss of voluntary power was complete, I had a constant tendency to put my feet down on their sides, and was obliged to keep my eyes upon them to keep the soles downwards, and thus avoid the risk of falling. Often I awoke in the night with a sense of discomfort, which I erroneously attributed to my legs being crossed and fixed in that position, but when they were looked at they were straight and apart. During the progress of the paralysis, I had an almost constant sense of tingling in the extremities, as though they were asleep. This did not pass until the morbid condition was fully developed and the loss of power was complete. When the climax was passed it subsided. There was severe neuralgic pain along the trunks of the nerves of the left arm, and in that limb alone, during the development of the paralysis. It was so severe as to deprive me of sleep, and was probably associated with some organic change going on in the nerves or their neurilema, as that arm was longer recovering than the rest of the body. Now, seven years after the illness, slight pressure along the course of the digital nerves gives a tingling sensation at the tips of the fingers, not experienced in the other hand, and the left hand is still a little weaker than the right. Improvement began about three months after the first symptoms of paralysis, or four months after the invasion of diphtheria. I had been depressed, and had apparently taken cold from the use of cold water douches, which had been recommended to me, and was driven to bed again by febrile symptoms and sore throat, almost like a miniature attack of diphtheria again. From this time I began to mend. It was first noticed as a favourable augury that galvanism, which had previously failed to excite any contraction of the muscles, began to produce slight twitching of the toes; and improvement after this was rapid. It was curious to notice that, as the loss of muscular power gradually progressed from above downwards, so the amendment was observable in the same order. Thus, when I had regained the power of reading, because the muscles of the eyeball had recovered their force, the paralysis was still in progress in the limbs below, and deglutition and the proper modulation of the voice returned to their natural condition long before I was able to walk. Neither the sphincters of the anus nor the bladder were affected at any time. Strychnia, with several preparations of iron, change of air, and generous diet, were the chief remedies. No specific remedies seemed of much use. The morbid condition no doubt ran its course, and then recovery began as a natural sequence.

'By the end of September in the same year I had quite regained the use of all the parts affected; and though somewhat weak, and sensitive to cold, I was substantially well. My general health has certainly been more robust since the diphtheria, and I bear fatigue better than before.'

One remarkable fact in the history of diphtheria remains to be noticed. If there be any wound or abrasion of the skin in a patient suffering under that disorder, it is apt to become covered with the pellicle, resembling wash-leather, which is characteristic of diphtheria of the fauces. Nay, such sores in persons not suffering primary diphtheria, but lying in an atmosphere charged with the diphtheritic poison, will assume the pellicle: and Trousseau affirms that such sores, so affected, have sometimes formed the door of entrance of the general diphtheritic disease into the body. Now all this is of practical importance. It teaches us to withdraw persons having open sores from the tainted atmosphere; it teaches us to abstain, in our treatment, from blisters, and even from inflicting leech-bites, and the little wounds made by the scarificator in cupping; it furnishes also additional evidence, were that needed, of the contagiousness of the disorder. Sir William Jenner, fully admitting its contagious character, says in a note: 'There is not the shadow of ground for the belief that the disease can be carried by the clothes, &c., from one house to another.' This, if it be true, and I do not mean to question its truth, is a most interesting fact. It furnishes one among other proofs that diphtheria is not—as some thought it was when it first appeared here in an epidemic form—is not a mere modification of scarlet fever, which is notoriously capable of being communicated by *fomites*. And a plausible explanation of the fact that diphtheria cannot be so conveyed is to be found in this other fact, that it is attended with no cutaneous eruption. I shall dwell more hereafter upon the doctrine that the natural mode of recovery from these specific fevers is by way of elimination of the poisonous elements or products of the disease, which escape from the body through different channels in different cases: by the skin and lungs in smallpox; by the throat, kidneys, and skin in scarlet fever. In diphtheria the elimination takes place chiefly, I imagine, by the lungs and the kidneys—and *not* by the skin. Hence no contagious material is collected or stored up in clothes or other substances in contact with the skin. The risk of catching it is through inhaling the patient's breath, or air contaminated by his breathings; or through receiving upon the mucous membrane of the pharynx the substantial products of the disease existing in the patient's throat. The same absence of any cutaneous affection accounts also, I think, for the absence of dropsy, notwithstanding the albuminuria. In so-called renal dropsy, the dropsy is due, in no inconsiderable degree, to suppression of the function of the skin.

Vague notions have been entertained that the diphtheritic membranes were consequences of the growth of a parasitic fungus. Microscopic vegetable epiphytes have indeed been noticed in some few instances, but, as in the thrush, they are always, when present, mere accidents of the disease.

The diagnosis of diphtheria is easy and absolute whenever you have the opportunity of seeing the peculiar exudation on the mucous membrane of the pharynx. You will suspect diphtheria when you are called to a patient having a sore and red throat, if that disease has recently occurred in the house, or is rife in the neighbourhood. When the question lies between scarlet fever and diphtheria, you will decide that the complaint is probably diphtheria if there is no cutaneous eruption, if the patient has already had scarlet fever, if the tongue presents no enlarged and very red papillæ. 'When the inflammation (says Sir William Jenner) has spread to the larynx, all doubt ceases in regard of diagnosis.'

Again, when any doubt arises whether you have to deal with diphtheria, or with infantile (or, as it might be called, catarrhal) laryngitis, you will incline to the less discouraging diagnosis if you observe other catarrhal symptoms in your little patient: sneezing, runnings from the nose and eyes; if you can trace back one or more previous attacks of a similar kind; and if no albumen is discoverable in the urine.

The prognosis you will readily divine from what has been said. It can never be very favourable or secure. It is worst when the larynx, or the nares, are implicated, when the pulse is very frequent or very infrequent, when vomiting occurs and abides long, and when there is epistaxis or delirium. The danger is also much greater in childhood than at the adult age.

Diphtheria is not a disease that requires, or will bear, depletion. It may be right to clear out the bowels at the outset by a gentle aperient. The internal remedies that have been most applauded are the chlorate of potass, and the tincture of the perchloride of iron. The latter may be given, at short intervals, in half-drachm doses, mixed with water. Possibly it may be of some benefit, locally, to the affected throat, in passing over it. It certainly makes it smart. Of course the dose of the tincture for a child would be less. Frequent gargling with cold water deserves a trial. A medical friend, who has undergone the disease in his own person, told me that he derived the greatest relief and solace from small morsels of ice, swallowed as soon as they dissolved in his mouth. It is needful that the patient should be well nourished, with bread sopped in beef-tea for example, with eggs, with iced milk, which is an excellent form of nutriment in these cases, and such-like food. If the strength is failing, the skin becoming dusky, and the pulse weak and frequent, wine or brandy in liberal doses will be indicated.

With respect to local treatment, there is one thing you must not do—though it was often done when the disease was less well understood than it now is—you must not tear off the membranous exudation. The extension of the inflammatory process may, however, sometimes be arrested or limited by local applications; by brushing the affected surface over with a strong solution of nitrate of silver—one part of the nitrate to three parts of distilled water; or, what I think still better, with a lotion composed of equal parts of hydrochloric acid and water. Both of these lotions *cause* whiteness of the mucous membrane to which they are applied, and this you must not forget. I have been informed by Mr. Courtney, of Leatherhead, who had seen many cases of diphtheria when it first became prevalent here, that he was very successful in removing the pellicle from the throat by applying to it, with a broad painting brush, a coating of creasote. The false membrane dissolved as it were, and disappeared under this treatment. Reapplication of the creasote the next day, and even for a third time, was sometimes requisite.

I would caution you against making any of these applications too frequently; lest you incur the risk of keeping up an inflammatory condition in the part; once a day is often enough.

When the distinctive symptoms declare that the exudative disease is present in the larynx, the question of tracheotomy is at once forced upon our attention.

There was a time when the existence of a false membrane in the larynx or trachea was thought to be prohibitory of the operation, or at least very discouraging as to its utility. But large experience has since shown that it may sometimes be successful.

Trousseau says, 'I have now performed the operation in more than two hundred cases of diphtheria, and I have the satisfaction of knowing that one-fourth of these operations were successful.' He thinks that half the cases operated on *in private practice* ought to be successful, when recovery is possible. He maintains that 'the earlier the operation is performed the greater are the chances of success'—and that there is a chance of success whenever the local mischief constitutes the chief danger; when the symptoms of apnœa predominate over all the patient's other symptoms. Success is all the more hopeful in proportion as the child is not very young. I have told you already at how very early an age life *has* been saved by tracheotomy.

Sir William Jenner writes much to the same purpose. He advises us to be sure, before resorting to the operation, first that the exudation has extended to the larynx, and secondly that the disease is advancing in severity, and of this last we are to judge by looking at the patient's chest, and observing the degree and increase of the recession of the yielding parts of its parietes during inspiration. These two points ascertained, the sooner the operation is done, the better. I cannot refrain from reading to you his description of an instance of its success, as performed upon the person of a physician.

'There is not a shadow of doubt,' he says, 'on my mind that he would have been dead in two minutes, had his larynx not been opened at the moment it was by Mr. Quain. I never saw anyone so manifestly brought back from the threshold of death. His complexion had that bluish pallor that precedes immediate dissolution. My hand was on his wrist. I felt his pulse failing under my finger, until at last it was imperceptible. His eyes closed, and his diaphragm was making those convulsive contractions which indicate that respiration is about to cease, when the knife entered the larynx, and air was drawn by what really seemed the last effort of the diaphragm into the lungs. The natural hue of his face returned; his pulse was again perceptible; his eyes opened; consciousness was restored; and the patient was alive again. He finally recovered. Now a thousand failures of the operation in saving life, cannot, after seeing this case, prove to me that tracheotomy ought not to be performed when suffocation is imminent from the presence of lymph in the larynx or trachea; for here is a man whose life was invaluable to his family and most useful to society restored to health, who, but for the operation, would have been dead.'

The operation is only less valuable when its sole result is the *euthanasia*. The same able physician, after describing the death, by asthenia, of a child twelve days after tracheotomy, goes on to say, 'Slow suffocation is one of the most distressing modes of death; death from asthenia one of the least. So that twelve days of life were gained, and much suffering was avoided by the operation.' In all cases the parents and friends should be admonished of the uncertainty of its event.

We are now prepared for the consideration of a most important question. Is the disease which has for so many years been called, in this country, *the croup*, and which is attended with a membranous exudation in the larynx, anything else than diphtheria? I believe it is not. I believe, with Dr. Johnson, that ever since Dr. Home's pamphlet on 'croup' was published in 1765, our writers on the subject have given us the history, the symptoms, and the treatment of acute catarrhal laryngitis, of what I have been describing as infantile laryngitis, with the morbid anatomy of diphtheria: thus confounding together two diseases very different in themselves, and requiring very different treatment.

The late Dr. Hillier seems to have been the first among English physicians to recognise and point out this error respecting the morbid anatomy of croup; an error, which as Dr. Johnson remarks, 'has been perpetuated by the fact that simple inflammatory croup is a far less fatal disease than diphtheritic croup. Most cases of the former recover when early and judiciously treated; while of the latter by far the greater number die. Therefore after death with croupy symptoms false membranes are more frequently present than absent.'

Writing in 1861, Sir William Jenner puts to himself the following question. Are diphtheria and croup essentially the same disease? and he answers it in these words. 'I think not: because there is no evidence to show that croup is anything more than a local disease—that it is contagious—that it occurs as a wide-spread epidemic—that it affects a large proportion of adults—that there is albumen in the urine—that symptoms of disordered innervation follow recovery from the primary affection.'

Against these reasons for his belief, Dr. Hillier offers what seem to me fair and satisfactory arguments. As to contagion, evidence of that property might probably have been found with respect to croup, had it been suspected and looked for. The very first two cases in which Dr. Home discovered the false membrane occurred in children of the same family, a boy aged 7, and a girl aged 5, she having sickened four days after her brother's death. For many years diphtheria was almost unknown in Great Britain except in its sporadic form; a form to which children may probably be more obnoxious than adults. Dr. Hillier asserts, from his own experience, that in severe cases of simple laryngitis, albumen may be found in the urine. With regard to the absence of symptoms of disordered innervation, these are not constant even after unequivocal diphtheria; and coming late, after the disease seemed at an end, they might easily be overlooked, especially when unexpected. It is remarkable that they were not noticed by Bretonneau in the epidemic which he has so minutely described.

You will understand that I give in my adhesion to the opinion that croup, accompanied by false membranes in the larynx and trachea, is always diphtheria—whether in the child or in the adult; and that simple laryngitis is never associated with the exudation of false membrane.

I have next to invite your attention to that laryngeal affection which is now commonly called *Laryngismus stridulus.* It is a disorder of infancy, and it has received a variety of names, which shows that it has been recognised as a distinct malady by various observers. In some sort it resembles, and has not seldom been confounded with, what Englishmen have been accustomed to call *the croup.* And it is spoken of sometimes as bastard croup, spurious croup, spasmodic croup. It is the *thymic asthma* of the Germans. The somewhat pedantic and cacophonous title of Laryngismus Stridulus was bestowed upon it by Dr. Mason Good. For my part I much prefer the homespun term *child-crowing*, first used, I believe, by my late friend Dr. Gooch.

The disease consists in spasmodic narrowing, or even perfect closure of the glottis. The child is seized all of a sudden, roused perhaps from its sleep, or checked during the act of sucking, by a catch or interruption of its breathing, more or less complete. It strives and struggles to expire, but is apparently unable to do so; at length, the effort is successful, and the breath is drawn in with a shrill whistling or crowing sound, like that which characterises the inspiration of infantile laryngitis, or of hooping cough, and depending upon the same cause—a narrowing (in this complaint temporary) of the fissure of the glottis. The crowing noise and its concomitant phenomena take place in paroxysms which vary in respect of frequency and severity, and which are separated by intervals of easy and natural breathing.

A former colleague of mine at the Middlesex Hospital, the late Dr. Ley, wrote, just before his death, a volume on this curious disorder, about the pathology of which he held a peculiar and ingenious, but far too partial and limited a view. I will give you his description of the phenomena of the attacks.

'When the closure of the chink of the glottis is not perfect, the child struggles for its breath: the respiration is hurried; the countenance generally bluish or livid; the eyes staring; and each inspiration is attended with a crowing noise. When the closure is more complete, the function of respiration is entirely suspended for a while; there is an effectual obstacle to the admission of air. The child makes vehement struggles to recover its breath. At varied intervals, from a few seconds up to a minute, or upon some occasions nearly two minutes, air is at length admitted through the glottis, now partially open; and this rush of air, passing through a very narrow chink, produces the peculiar sound. To these symptoms not unfrequently succeeds a fit of coughing or crying, which terminates the scene: or, if the glottis be not thus partially opened, the child, at the end of from two to three minutes at the utmost, will die suffocated. Pallid and exhausted, it falls lifeless upon its nurse's arms; and it is then that the child is generally said to have died in a fit.'

Sometimes, but not always, with the symptoms now described there is a contracted state of the flexor muscles of the thumb, fingers, wrist, ankle, and toes; giving to the foot an appearance approaching to that of club-foot, and sometimes there are general convulsions.

Formerly, most persons who had learned not to confound this child-crowing with inflammatory croup, were of opinion that it depended upon *cerebral* disease, or disorder. This was the doctrine of Dr. John Clarke, who has left a very good description of the complaint, which he called 'a peculiar species of convulsions.' No doubt it may occasionally proceed from some central disease within the cranium or the spinal canal, but in its ordinary form it is a purely reflex disorder. Dr. Ley attributed the temporary closure of the glottis to pressure made by enlarged glands in the neck or chest upon the recurrent nerve, or upon some part of the eighth pair: 'subverting the exact antagonism by which the glottis is automatically and involuntarily kept open, and allowing its margins to come together, and to occasion the peculiar kind of inspiration so much like that of inflammatory croup.' But the true pathology of child-crowing covers wider ground, and finds its explanation in the general principles of reflex action propounded by Dr. Marshall Hall. You are probably aware that the late Dr. John Reid ascertained, by a well-contrived set of experiments, that the inferior laryngeal (or recurrent) nerve, is an efferent or motor nerve, by which nearly all the movements of the larynx are regulated; and that the superior laryngeal is an afferent or incident nerve. You will easily perceive, therefore, how pressure upon, or irritation of, either of these nerves, may affect the aperture of the glottis. If the superior laryngeal nerve be implicated, the impression is communicated to the spinal cord, and thence reflected, through the recurrent, upon the laryngeal muscles. Irritation of the *gastric* ramifications of the par vagum may have the same result. It is an observation of Dr. John Clarke's, that the attacks 'very commonly take place after a full meal.' Nay, not only *any* of the afferent fibrils of the eighth pair of nerves, but those of the fifth pair also have a similar exciting power; for a transient crowing is readily produced in some children by exposure of the surface of the face and chest to a breeze of wind, or by their being suddenly tossed in the arms of a nurse. The irritation of the gums during dentition is a common exciting cause of the spasm. We must even suppose that the effect produced upon the central cord may, by reflexion, influence other muscles, and cause the carpopedal contractions that are so frequently to be noticed. Again, if the recurrent nerve itself be pressed upon, or interfered with, undue contraction or paralysis, according to the kind and degree of interference, will be likely to ensue of the muscles belonging to the glottis. Spasm of those muscles would close the chink, and stop the breath. And it was shown by Dr. Reid that their palsy, except while the breathing is perfectly quiet and tranquil, sensibly impedes inspiration, and alters its character.

The practical *fact* which you have to remember is, that stridulous breathing may occur, and return in paroxysms, when there is no laryngitis. And the practical *lesson* which you have to learn is, how to discriminate between these two similar, yet different disorders. I have already specified the distinctive characters of inflammatory croup. The complaint that copies it may be known by its sudden accession, and its sudden departure; by the freedom of breathing in the intervals between the paroxysms; by the absence of fever, of preceding or present catarrh, of hoarseness, and of any abiding cough. The diagnosis, easily enough reached when these points are sufficiently attended to, will be confirmed, if you find that the child is cutting its teeth, that its gums are hot, tense, and tender.

According to Dr. Clarke, 'convulsions of this description seldom, if ever, occur after the expiration of the third year of a child's life.'

It must be unnecessary for me to urge the *importance* of the diagnosis. Those active measures which befit the outset of the inflammatory disease, would be misplaced and mischievous in the other. Do not, however, imagine that this disorder, child-crowing, is a trifling disorder, and unattended with danger. It is really a perilous, as well as a terrifying condition. The respiration is sometimes so long suspended that death takes place in the paroxysm. And each paroxysm is accompanied by a tendency to stagnation and congestion of blood, in the brain, lungs, and heart: a tendency which, by its frequent repetition, may lay the foundation of serious and fatal disease in one or other of those vital organs.

The treatment of this affection must depend a good deal upon the nature of the predisposing and exciting causes. Great care must be taken, in all cases, to regulate the state of the bowels, and of the skin. *Fresh air* also is a powerful adjuvant; and sometimes of itself a sufficient remedy. Change of place, therefore, and especially a removal from the air of a city or town to the purer atmosphere of the country, should be urged whenever that is practicable.

Dr. Wm. Budd announced some time ago that in ten or twelve instances, he had observed a speedy subsidence of this disorder under from five to ten grains of the phosphate of lime, administered three times a day in chalk mixture. In reference to this statement, it is interesting to learn that in every case, save two, of laryngismus stridulus which has fallen under the observation of Sir William Jenner at the Children's Hospital and elsewhere, the child was the subject of *rickets*.

In the paroxysm itself the warm bath might be useful, if it could be got ready in time. The application to the throat of the hot sponge is a more accessible, and often a very effectual expedient. Sprinkling the face and chest freely with *cold* water will sometimes unlock the spasm, and set the little sufferer free.

Besides the affections which I have now described or referred to, the larynx is liable to *chronic* disease: to chronic *inflammation*; chronic *thickening* of the membrane; slow *ulceration*; necrosis of its cartilages. Chronic inflammation and ulceration of that part is very common in *consumptive* patients. It is attended first with hoarseness, then with aphonia, a barking or stridulous cough, and all the melancholy accompaniments of tubercular phthisis. There has accordingly been a species of phthisis spoken of as *phthisis laryngea.* But in most, if not in all cases, this laryngeal affection is only a part of the complaint under which the patient labours; and what I have further to observe respecting it, I shall postpone until we come to the consideration of tubercular consumption.

Again, the membrane lining the laryngeal cartilages is not unfrequently thickened and ulcerated in *secondary syphilis*: giving rise to a hoarse croaking voice, and to noisy and painful breathing. In such cases, or in chronic thickening of the same parts from common inflammation, you may do great good by *gently* introducing mercury into the system, until the gums rise. I have again and again seen the uneasiness about the throat, the noisy respiration, the rough or whispering voice, all cease, as if by enchantment, so soon as the specific influence of the mercury became manifest. It may be well to make a previous trial of the iodide of potassium: or rather, with my present experience, I would recommend the combination that I have already mentioned, of the iodide of potassium with the perchloride of mercury. There was a woman who used to apply at the Middlesex Hospital for an affection of this kind: whether it was syphilitic or not I could not well determine, but she lost it under the employment of mercury, two or three times: the complaint returning again after the interval of a few months, upon the reapplication of some irritating cause. In another female patient, who was long under my care in the hospital with similar symptoms, everything failed to give permanent relief, till I began to leech the neighbourhood of the larynx repeatedly. She had four leeches applied, I think, every night, and then every other night, for a fortnight or three weeks; the hoarseness and difficulty of respiration gradually diminishing all the time, until at length the perfect use of the instrument of the voice was restored. In these cases, while using local depletion, or mercury, it is necessary to uphold the strength of the patient by nourishing but unstimulating diet: and it is always desirable that the organ should be kept, as much as possible, in a state of repose.

The lining membrane of the larynx is liable also to warty growths, which impede the entrance and exit of air, and may ultimately destroy life. There are many examples of that kind on record. I extract the following from my hospital note-book:—

George Tenon la Font, aged 11, admitted March 4, 1828. He speaks in a whisper; complains of difficult breathing, and of cough. Inspires with a loud wheeze. Coughs with a sort of whistling sound, as through a narrow tube. The cough is most troublesome at night. Expectoration mucous, and inconsiderable in quantity.

Has been ill, in this way, all the winter—having had hooping-cough in the preceding autumn. There are marks of cupping on his throat. Little can be heard in the chest, the loud wheeze of his respiration obscuring all other sounds. In about a fortnight his gums were brought under the influence of mercury. No perceptible improvement ensued. A careful examination was again made of the thorax, and the conclusion arrived at was, that the obstacle to his respiration lay in the larynx, or upper part of the trachea, and that the lungs themselves were not concerned. After this, a blister to the throat, a seton near the thyreöid cartilage, small doses of ipecacuan, emetics, and iodine were successively tried—but in vain. Towards the end of the month he began to suffer, occasionally, very violent and apparently spasmodic attacks of extreme dyspnœa. He died, during the night, two months after his admission. For some days before, he had been manifestly worse than usual, was more feeble, wandered somewhat, and complained that his vision was imperfect. No noticeable increase had taken place in the difficulty of breathing, except during the paroxysms of aggravation already mentioned. His death was sudden, and probably took place in one of these paroxysms.

When the body was examined, the lungs were found sound as to structure, but copiously infiltered, especially on the left side of the thorax, with serous fluid. At the very top of the larynx, involving the base of the epiglottis and the vocal cords, was a considerable warty growth, closing the rima glottidis almost entirely. The excrescences sprang *chiefly* from one continuous base, and branched out precisely after the manner of what is vulgarly called a seedy wart. There were, however, several distinct smaller growths or warts. The main excrescence, having several heads, passed upwards from and through the rima, and so came to act partly as a valve during inspiration, which was always sensibly more difficult than expiration.

Now had the laryngoscope been at that time invented, this poor boy would have been spared much of the unnecessary and useless discipline which he underwent. The warts would have been *seen*. Perhaps they might have been removable. In the fifty-first volume of the 'Medico-Chirurgical Transactions,' Dr. Johnson has published the history of seven cases in which he succeeded, by the aid of the laryngoscope, in removing a morbid growth from one of the vocal cords. It is remarkable that in all the seven, the morbid growth sprang from the true vocal cord on the *right* side. All the growths but one were warty in character, and appeared to consist almost entirely of modified epithelial cells.

Even if the growth had not been capable of being detached in la Font's case, his distress might have been relieved (its exact cause being known), and his life indefinitely lengthened, by tracheotomy; but the boy would have had to breathe through an artificial tube for the remainder of his life. A private patient of mine wore such a tube for three years and four months, till he died of consumption. Should the obstacle be of a malignant kind, the operation may still give present ease, and prolong life. At a meeting of the Pathological Society while I was its President, Mr. Curling detailed a case of epithelial cancer of the larynx, in which the disease ultimately made its way into the œsophagus. But the patient lived for twelve months after an opening was made into his trachea. He wore a silver tube, and for a while regained flesh and strength. The tube was ingeniously fitted with a valve opening inwards, which enabled him to inspire through the instrument, and to expire through the glottis, and therefore to *speak*. We learn from this case that cachexy, or the aspect and complexion of malignant disease, need not forbid the operation.

There are two excellent specimens of warty growths in the larynx upon the table before you.

I might have referred, when speaking of chronic enlargement of the tonsils, in the last lecture, to the case of a little boy at present under the care of one of my colleagues. He was brought to the hospital on account of great dyspnœa, and a hissing respiration, produced apparently by two enormous tonsils. With some difficulty (arising from his unmanageable age) a large part of one of the tonsils was cut off with scissors: but after the operation (either from some fresh swelling of the parts, or from pressure made by the remaining tonsil, which grew downwards, I understand, into the throat), his difficulty of breathing became extreme; and it was thought necessary to perform tracheotomy, which afforded him signal relief. He breathed for some time through the artificial opening in his windpipe. At length the other tonsil was partly removed: and the child is now well, and about to be discharged.

END OF THE FIRST VOLUME.

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